WIRELESS ENGINEER

THE JOURNAL OF RADIO RESEARCH & PROGRESS

DECEMBER 1955

VOL. 32 No. 12 · THREE SHILLINGS AND SIXPENCE

AVO
REGD. TRADE MARK

WIDE RANGE
Signal
GENERATOR

An inexpensive yet precision instrument designed specially to meet the exacting needs of the modern service engineer and laboratory technician. With six frequency ranges covering 50 Kc/s to 80 Mc/s, its accuracy is better than ±1% of the scale reading.

50 Kc/s-150 Kc/s	1·5 Mc/s-5·5 Mc/s
150 Kc/s-500 Kc/s	5·5 Mc/s-20 Mc/s
500 Kc/s-1·5 Mc/s	20 Mc/s-80 Mc/s

Scale sub-divisions provide more than adequate discrimination for use in television circuits. Note the starred features below, which combine to maintain a minimum signal of less than 1μV up to 20 Mc/s and less than 3μV between 20 Mc/s and 80 Mc/s.

1
2
3
3
4
5
5
7
7
6
SIGNAL GENERATOR

★ **OUTPUT** — 1
Co-axial socket for attenuated output. Force socket located totally within H.F. compartment.

MAINS TRANSFORMER — 2
Marked tagboard for inputs of 100-130 V and 200-260 V, A.C. 50/60 c/s.

★ **CAST ALUMINIUM H.F. COMPARTMENT and CHASSIS** — 3
Large number of fixing holes for H.F. compartment cover ensures excellent electrical bonding and good screening.

FUSE — 4
Easily accessible when replacement is necessary.

VALVES — 5
Standard types run at a rating to ensure long life.

TURRET COIL SWITCHING — 6
Standard "AVO" practice.

★ **ATTENUATOR SYSTEM** — 7
Employs close tolerance, high stability midget carbon resistors, low reactance rotary potentiometer modified for H.F. operation with carefully designed screening.

Other features include:

ILLUMINATED SPOT RANGE SELECTOR
Gives rapid identification of operational band with intensified lighting round precise frequency. Fine hair line gives close discrimination, particularly on high frequencies.

STOPS
Separate stops prevent turning of dial with respect to condenser.

★**MAINS FILTER SYSTEM**
This is screened from main electrical assembly.

BUSHING PLATES
provide additional rigidity for rotary controls.

SLOW MOTION DRIVE
Substantially free from backlash.

MAINS MODEL 100-130 V and 200-260 V. A.C., 50-60 c/s
OR BATTERY MODEL.........£30

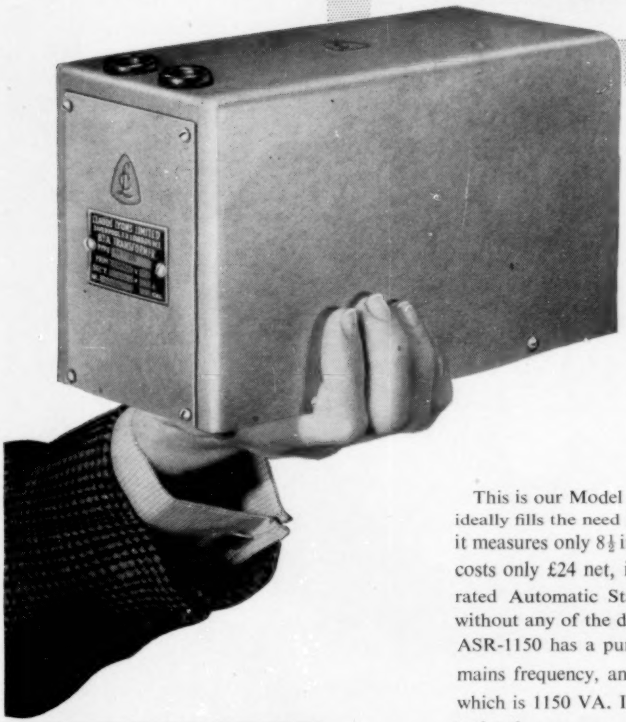
AVOCET

Regd. Trade Mark

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
AVOCET HOUSE · 92-96 VAUXHALL BRIDGE ROAD · LONDON · S.W.1
Telephone : VICtoria 3404 (9 lines)

S.G.2

A NEW-PRINCIPLE A-C AUTOMATIC VOLTAGE STABILISER



This is our Model ASR-1150 Automatic Voltage Step Regulator. It ideally fills the need for a cheap, small and light Stabiliser. Although it measures only $8\frac{1}{2}$ in. × $4\frac{1}{2}$ in. × 5 in., weighs as little as 11 lb., and costs only £24 net, it has a performance fully equal to any similarly rated Automatic Stabiliser of the resonated, saturated core type, without any of the disadvantages.

ASR-1150 has a pure output waveform, is unaffected by changes in mains frequency, and works equally well from no-load to full load, which is 1150 VA. It has a stabilised output at 230V unless otherwise ordered.

Many other Automatic Voltage Stabilisers are now manufactured by us, and all are available for immediate delivery. In some cases the constancy of output is as high as 0.15%. Models are available from 200 VA to 30 kVA, single phase. 3-Phase Stabilisers are also available. Prices are *extremely* competitive.

We can supply from stock all types of American tubes, condensers, valves, potentiometers, etc.

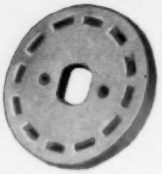
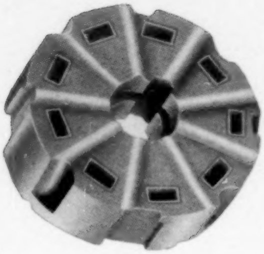
MEMO: If you are interested in infinitely-variable Transformers, do not forget the almost indispensable "VARIAC" (Reg'd. Trademark). Models are available from 170VA to 21kVA. Our Catalogue V-549 (3rd Edition) tells the whole story and will gladly be mailed free and post free, on request.

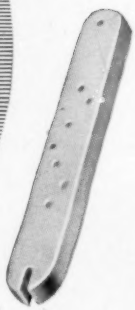
The *NEW "ASR-1150"* costs only *£24* net

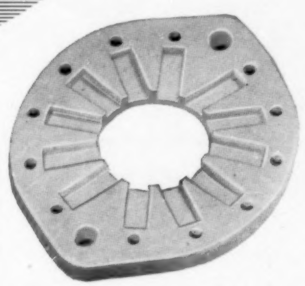
Complete information is obtainable from:

CLAUDE LYONS LTD., *STABILISER DIVISION,*

HEAD OFFICES & WORKS: 76 OLDHALL STREET, LIVERPOOL 3, LANCS.
SOUTHERN FACTORY: VALLEY WORKS, WARE ROAD, HODDESDON, HERTS.
(A10 main London/Cambridge Road, at Junction of A602)





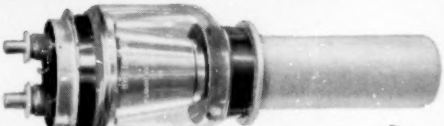
for radio ceramics

STEATITE & PORCELAIN PRODUCTS LTD.

Stourport-on-Severn, Worcestershire. Telephone : Stourport 111. Telegrams : Steatain, Stourport

SP88

Valves for R.F. Heating



POWER OSCILLATORS

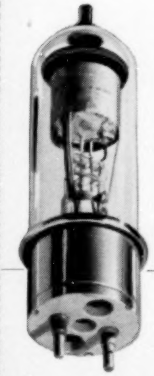
The increasing use in industry of R.F. heating has shown the need for units to provide outputs between 10 and 50 kW. These two products of the English Electric Valve Company are designed for R.F. generators of 6 kW and upwards, and have been developed expressly for operation under the arduous conditions imposed by factory use. Both types are available in air-cooled and water-cooled versions.

Type	Maximum operating Frequency (Mc/s)	Cathode	Dimensions (maximum)		Filament		Maximum Anode Voltage	Maximum Anode Dissipation (kilowatts)	Useable Emission (Amperes)	Amplification Factor	Mutual Conductance (mA/V)
			Length mm.	Diameter mm.	Volts	Amperes					
BR.1102	50	Th.	483	241	8·2	230	12·0	20·0	45	42	20·0
BW.1102	50	Th.	473	152	8·2	230	12·0	20·0	45	42	20·0
BR.1103	100	Th.	356	203	6·0	120	8·5	10·0	16	25	9·5
BW.1103	100	Th.	343	116	6·0	120	8·5	10·0	16	25	9·5

Th. denotes Thoriated Tungsten. BR. denotes Air-cooled. BW. denotes Water-cooled.

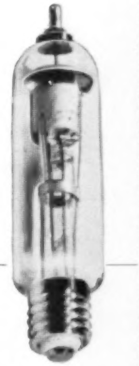
……

POWER RECTIFIERS



English Electric Valve Company produce these two power rectifiers, which are particularly suitable for use in connection with the power oscillators described above. The range also includes mercury vapour filled and xenon filled rectifying valves with outputs from 7kW to 630kW. Full data and operating instructions for these and for power oscillators are available on request.

Tube Type	C.V. Number	Filling	Output in Kilowatts
AH.211	CV.532	Mercury vapour	90
AH.221	CV.5	Mercury vapour	36



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ENGLISH ELECTRIC VALVE CO. LTD.

Waterhouse Lane, Chelmsford
Telephone: Chelmsford 3491

AP 300/27

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LOW COST, HIGH QUALITY

MAGNETIC RECORDING PAPER BASED TAPE

- LET THIS NEW TAPE SPEAK FOR ITSELF
- MANUFACTURED BY ONE OF THE COUNTRY'S LEADING POWDER METALLURGICAL LABORATORIES
- MIRROR SMOOTH FINISH TO REDUCE FRICTION AND WEAR ON HEADS
- EMBODYING QUALITIES FOUND IN THE MORE EXPENSIVE TAPES
- 7" DIA. IMPROVED UNIVERSAL SPOOL CONTAINING 1200 FEET

RETAIL PRICE **£1** *WITH FULL TRADE DISCOUNT*

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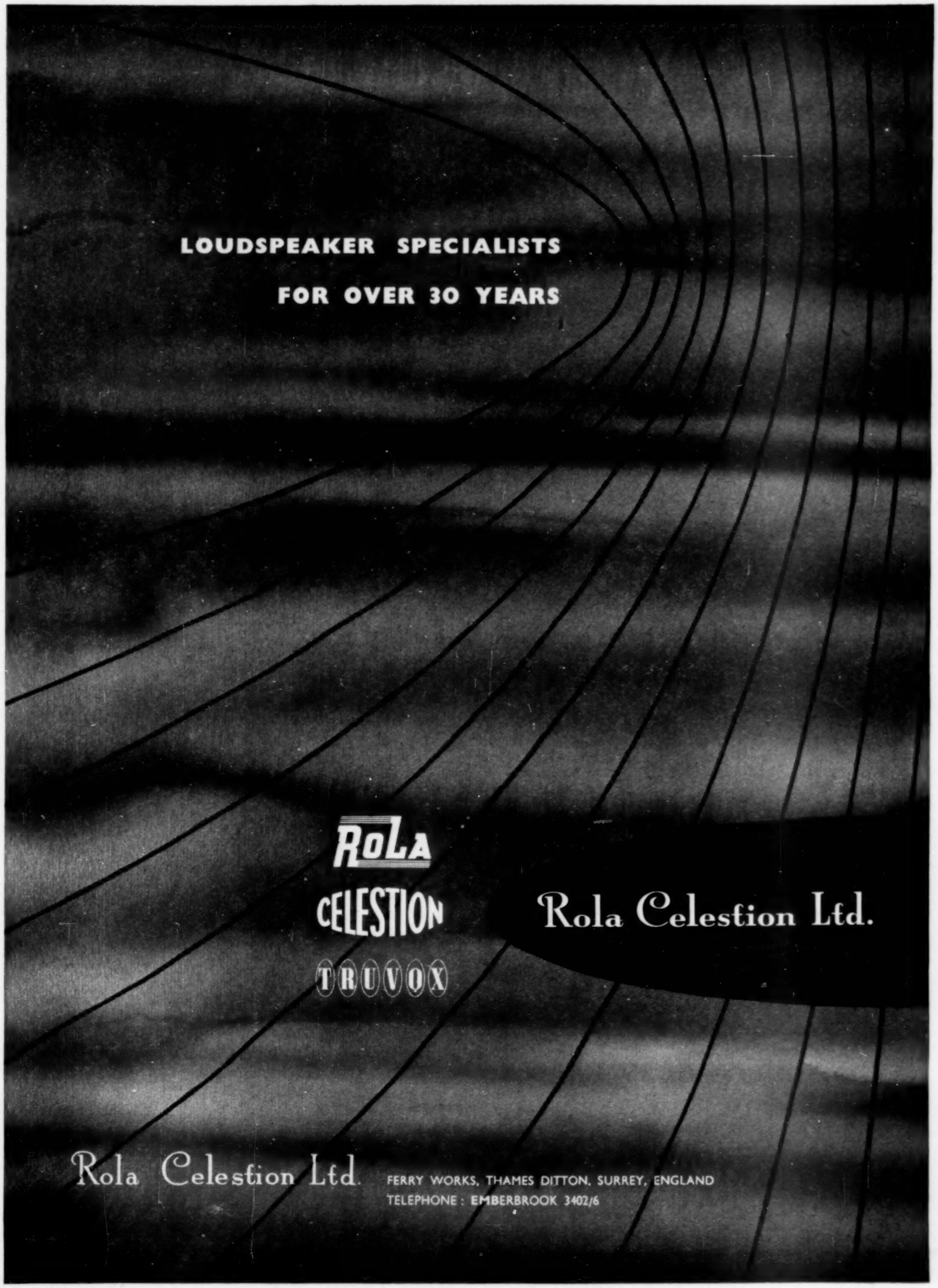
LONDON OFFICE: MAGNET HOUSE · KINGSWAY · WC2 · *Tel: Temple Bar 4669*

A Subsidiary of THE GENERAL ELECTRIC COMPANY LTD. OF ENGLAND



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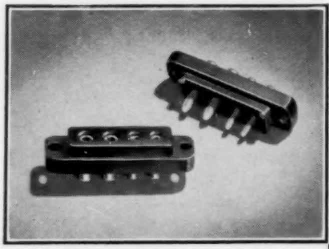
RoLa
CELESTION
TRUVOX

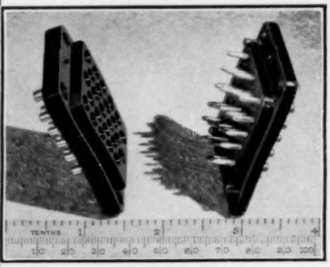
Rola Celestion Ltd.

Rola Celestion Ltd.
FERRY WORKS, THAMES DITTON, SURREY, ENGLAND
TELEPHONE : EMBERBROOK 3402/6

Inter-unit connectors



"UNITORS"


TENTHS
1
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10
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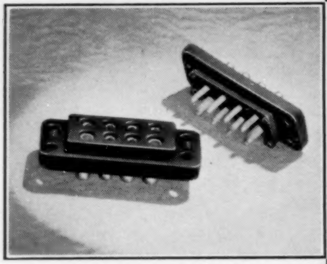
50
60
70
80
90
100

for 4 to 25 contacts



LIST NO.	PINS	BODY SIZE
L.653/P&S	4	1.7/16″× 13/32″
L.654/P&S	8	1.31/64″× 37/64″
L.655/P&S	12	1½″× 25/32″
L.656/P&S	18	2″× 27/32″
L.657/P&S	25	1¾″× 1.3/16″

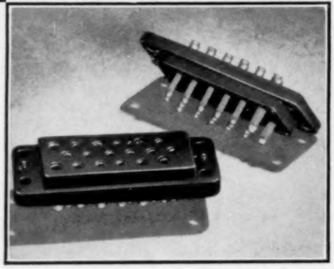
Working volts: 500V. Peak, pin to pin

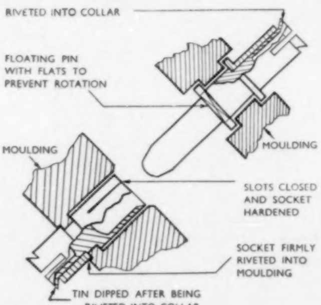
These Unitors are now widely used to facilitate the uncoupling of sub-assemblies for servicing or replacement. They conform to R.C.S. 321 and have Joint Service and A.R.B. approval.

Each coupling consists of a block of plugs and one of sockets, arranged so as to be non-reversible. Bodies are moisture and tracking-resistant, being moulded from a nylon-filled phenolic material. Pins are of high grade brass silver-plated. Hard gold-plated pins for lower contact resistance will be available shortly as an alternative finish. Pins carry 3 amp, but each block has two larger pins carrying 10 amp each. All pins are fully floating. Sockets are of differentially hardened beryllium copper; solder spills of both plugs and sockets are slit to facilitate soldering. All plugs and sockets are numbered on both sides of the moulded body.

Die-cast light alloy covers provide a flex lead connector. Newer types of covers and retainers are under development and these will be freely interchangeable with all existing types, which will be continued as standard until the new versions are freely available.

U.K. Pat. 649,739. French Pat. 990017. Swiss Pat. 277799.




RIVETED INTO COLLAR
FLOATING PIN WITH FLATS TO PREVENT ROTATION
MOULDING
MOULDING
SLOTS CLOSED AND SOCKET HARDENED
SOCKET FIRMLY RIVETED INTO MOULDING
TIN DIPPED AFTER BEING RIVETED INTO COLLAR

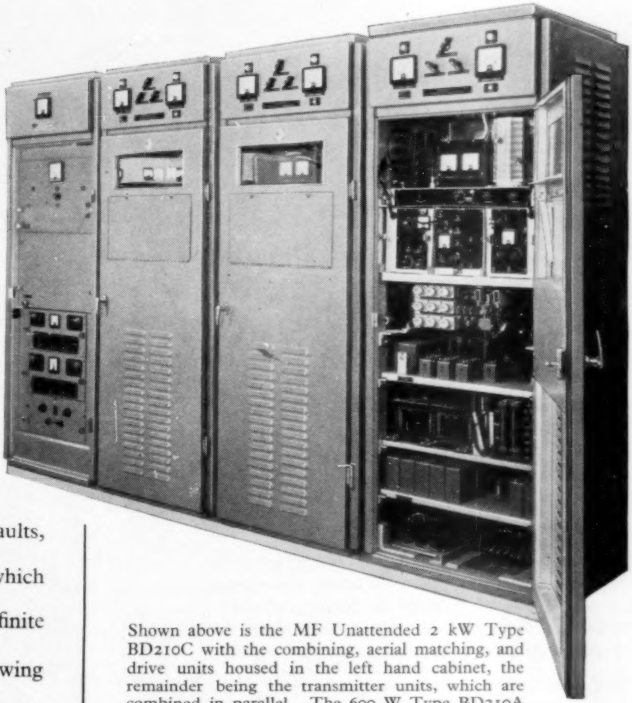
BELLING & LEE LTD

GREAT CAMBRIDGE ROAD, ENFIELD, MIDDX., ENGLAND

Telephone: Enfield 3322 · Telegrams: Radiobel, Enfield

Marconi Broadcasting Transmitters

The greatly differing needs of broadcasting systems and stations call for many types of transmitters. Marconi's make ten types as standard, and these can be modified to provide for variations in requirement. Equipment for paralleling transmitters offers advantages in continuity of transmission while dealing with faults, and Marconi's have evolved a system which introduces an isolating circuit of nearly infinite impedance between transmitters whilst allowing output signals to pass into a common load. This system may be arranged for efficient and economical operation at half power.



Shown above is the MF Unattended 2 kW Type BD210C with the combining, aerial matching, and drive units housed in the left hand cabinet, the remainder being the transmitter units, which are combined in parallel. The 600 W Type BD210A and 1¼ kW Type BD210B utilise one or two transmitter units respectively. This series has been designed to serve the recent trend in technique which calls for unattended transmitters set up at a predetermined frequency and thereafter completely remote-controlled.

The first advertised radio programme was broadcast from Marconi's Chelmsford transmitter in 1920. Today 75% of the countries in the world rely on Marconi broadcasting equipment.

Lifeline of communication

MARCONI

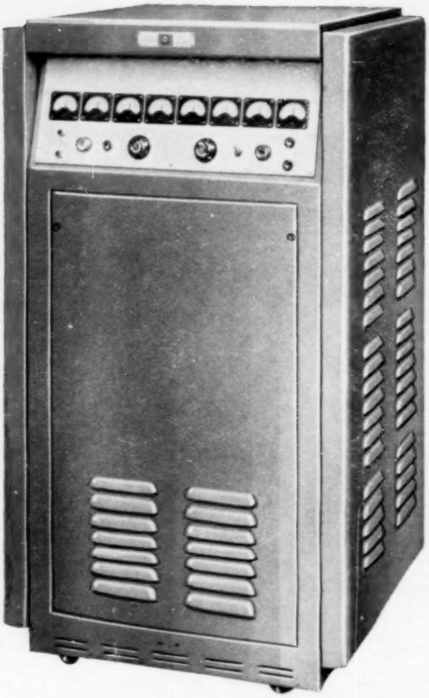
Complete Broadcasting and Television Systems

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

Partners in Progress with The '**ENGLISH ELECTRIC**' *Company Ltd.*

LB 4

20 Mc/s FREQUENCY MONITOR



The Automatic Frequency Monitor (20 Mc/s) is but one of a series of high grade monitors now in course of manufacture for the accurate measurement of frequency.

Employing hard valve techniques throughout, it will measure any frequency in the range 10 c/s to 20 Mc/s to an accuracy within ± 1 part in 10^6.

The result, in decimal notation, is presented on eight panel mounted meters each scaled from 0 to 9 and the unknown frequency is automatically remeasured every few seconds.

This new equipment presents a considerable advance in frequency measuring techniques and apart from normal laboratory applications, is ideally suited for incorporation in production testing routines.

Full technical information on this and other frequency measuring equipment is available on request.

CINEMA TELEVISION LTD

A COMPANY WITHIN THE RANK ORGANISATION LIMITED

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F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester, 16

5 good reasons for using

BICC POLYPOLE CABLE COUPLERS!

Designed for the outdoor connection of Specialized Remote Control Units, Centimetre Radio Links, Ground Radar, Television Camera and Industrial Electronic Equipment.

Moulding techniques ensure a tough, permanent, moisture-resistant assembly which virtually eliminates the possibility of conductor breakages at the coupler.

Screwed lock rings provide forced engagement and withdrawal. The overall metal housing is replaceable if damaged.

The cable itself is designed with a symmetrical cross section to provide the greatest reliability during handling.

The conductors are embedded in the moulding in the same geometric formation as in the cable so that each contributes to the strength of the connection.

Both panel mounting and cable couplers can be supplied, with insulated tails and cable lengths respectively cut to meet individual requirements.

Full details of our standard range of Polypole Couplers and Cables are available on request.

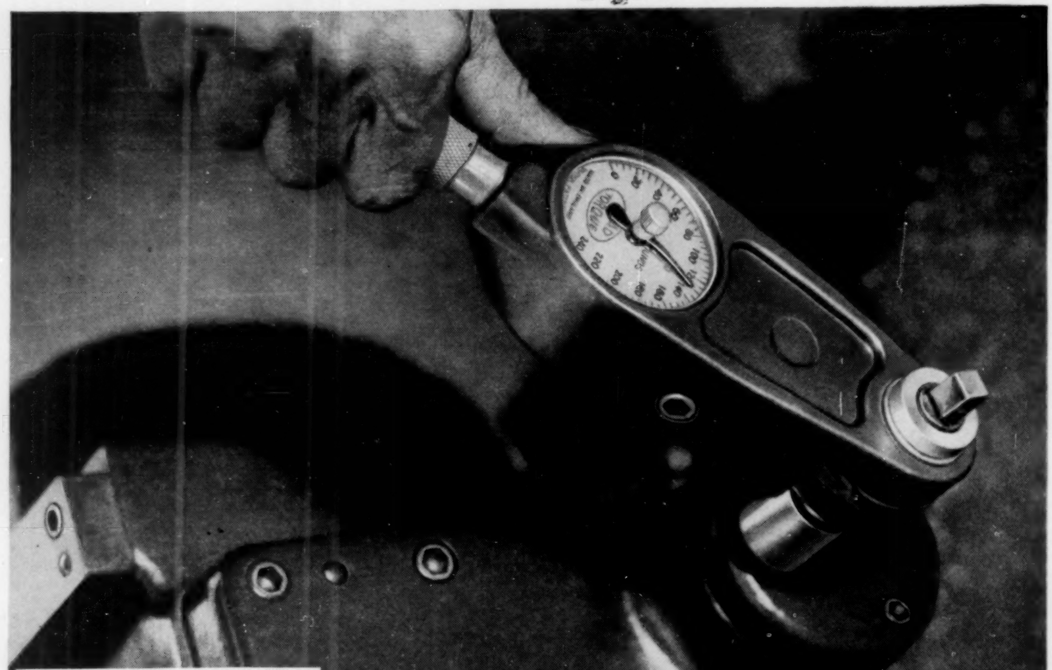
BICC are always glad to advise on the use of Polypole Couplers and Cable to meet customers' special requirements.

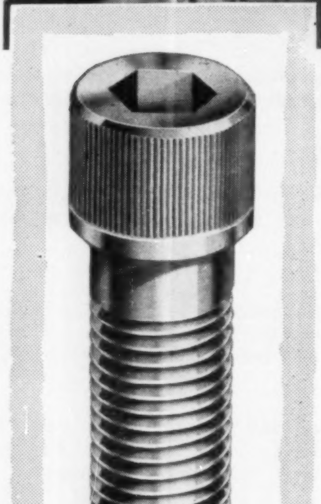
BI Callender's

BRITISH INSULATED CALLENDER'S CABLES LIMITED

21 BLOOMSBURY STREET, LONDON, W.C.1

HAND TIGHT ?





OR WRENCH TIGHT

A calibrated wrench shows us that Unbrako socket screws will stand far greater torsional strain than other screws of the same size without distorting or breaking. Higher predetermined tightening torques can therefore be applied on assembly with subsequent assurance of increased resistance to slackening, and safety under conditions of dynamic loading.

This is just one more link in the production chain from research to final approval of the finished screw, which ensures that Unbrako screws will give unsurpassed service life.

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These versatile resins have a remarkable range of characteristics and uses.

They are used
- ✱ for bonding metals and ceramics.
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AP 264-141

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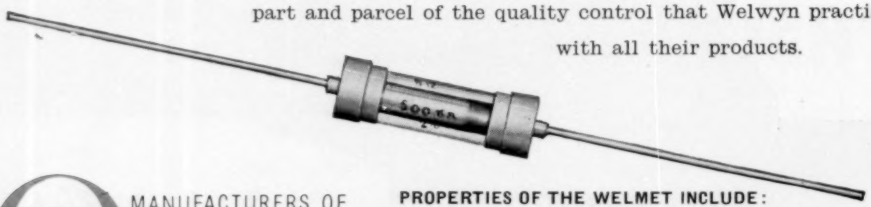
TRIAL BY STEAM

Sweltering in superheated steam may be some people's way of achieving perfection—Welwyn find this method ideal for *ensuring* it. For to test their hermetic sealing, Welmet metal film resistors undergo a Turkish Bath treatment in a pressure of two atmospheres. A drastic test indeed, but it proves beyond all doubt whether the vital gold-platinum alloy element is effectively protected. And it's part and parcel of the quality control that Welwyn practise with all their products.



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WELWYN
ELECTRICAL
COMPONENTS

PROPERTIES OF THE WELMET INCLUDE:

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No resistance change under tropical conditions

A rating of 1 watt at 70°C

A range of values from 1000Ω to 1MΩ

Selection tolerances of ±1%, ±2% and ±5%

The maximum voltage is defined only by the dissipation

WELWYN ELECTRICAL LABORATORIES LTD • BEDLINGTON • NORTHUMBERLAND

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good magnetic characteristics *demand*

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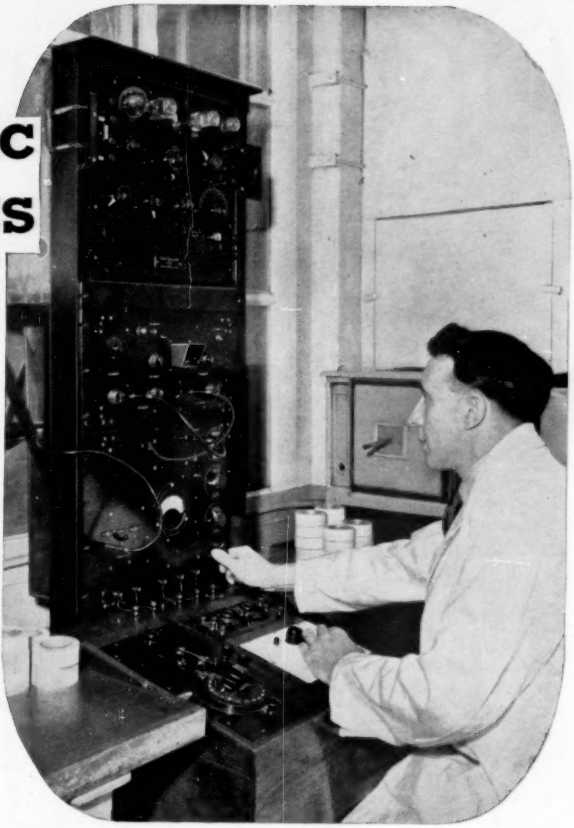

Standard maintains its established leadership in the manufacture of high permeability magnetic alloys by constant vigilance in the control of each and every production process, one of which is illustrated here. Produced by a Company which has the unique advantage of being a large-scale user of its own magnetic materials, a long experience of the applications of these materials gives full appreciation of the properties essential for uniform electrical characteristics and stable performance.

It will pay you to investigate the capabilities of *Standard* magnetic alloys with relation to your specific requirements.

- PERMALLOY 'C' for highest initial permeability, useful for wide-band frequency transformers, current transformers, chokes, relays and magnetic shielding.
- PERMALLOY 'B' has lower initial permeability than Permalloy 'C' but higher values of flux density. Suitable where high permeability to alternating field is required superimposed upon a steady polarising field.
- PERMALLOY 'D' for very high resistivity without undue lowering of the maximum flux density. Variation of permeability with frequency is small. Ideal for H.F. applications.
- PERMALLOY 'F' for high flux density, very rectangular hysteresis loop, with a retentivity of at least 95% of its saturation value and low coercive force. Ideal for saturable reactors, magnetic amplifiers, digital computors, memory devices, etc.
- V-PERMENDUR for high permeability with a very high value of maximum flux density. Finds special application for use as high quality receiver diaphragms, also motor generators and servo-mechanisms in aircraft where weight and volume are important factors.

Standard Telephones and Cables Limited

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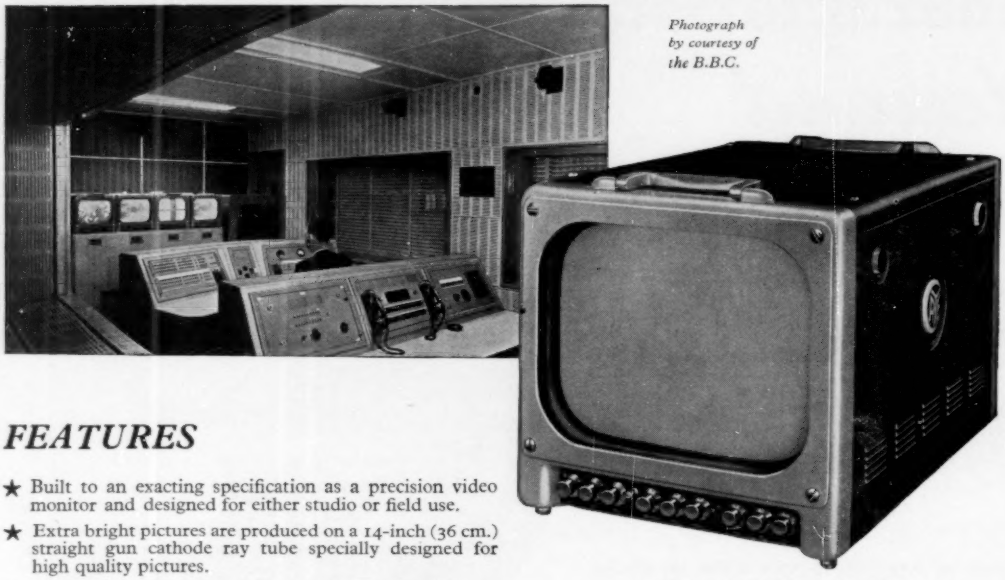
PYE PRECISION MONITOR



Photograph by courtesy of the B.B.C.

FEATURES

- ★ Built to an exacting specification as a precision video monitor and designed for either studio or field use.
- ★ Extra bright pictures are produced on a 14-inch (36 cm.) straight gun cathode ray tube specially designed for high quality pictures.
- ★ Wide frequency response to enable the monitor to be used for picture quality checks.
- ★ Will operate on either a composite signal or separate video and synchronising waveforms.
- ★ Separate heater and power transformers with dual primary windings to cover wide range of a.c. power input voltages.
- ★ Design incorporates stabilised B+ supply and a 14 kV regulated high voltage system for the cathode ray tube.
- ★ Optional use of either a d.c. restorer or a black level clamp by means of internal plug and socket selector switch.
- ★ All picture controls are arranged on the front recessed panel.
- ★ Front panel controls for d.c. operated vertical and horizontal picture shift circuits.
- ★ Provided with easily removable top, bottom and side panels to facilitate maintenance.
- ★ Silent extractor fan on rear panel ensures stable temperatures during long periods of operation.
- ★ Mobile adjustable stand, waterproof hood, and rack mounting attachment available as accessories.

PYE are supplying 200 of these Monitors to the B.B.C.

Other customers include:

Ministry of Works

The G.P.O.

High Definition Films Ltd.

Bristol Aeroplane Co.

U.K. Atomic Energy Authority

Associated Broadcasting Co.

Associated Rediffusion Ltd.

Granada TV Network Ltd.

Independent Television Authority

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270, Park Avenue,
New York.

Cables: PYETELECOM CAMBRIDGE

Telephone: TEVERSHAM 3131

Band III Converters

The new commercial programmes are bringing a tremendous demand for Television adaptors, for which the following **Osram** VALVES are recommended . . .

Type	Description	Filament or Heater		Impedance ohms	Conductance mA/V	Anode Voltage max.	Screen Voltage max.	Base
		Volts	Amperes					
B319	R.F. double triode ...	7.0	0.3	4,000	6.0	250	—	B9A
LZ319	Triode pentode V.H.F. frequency changer: triode section pentode section	9.0	0.3	4,000 —	5.0 6.0	250 250	— 200	B9A
X719	Triode Heptode frequency changer ...	6.3	0.3	1,000,000	0.775	300	125	B9A
***Z77**	R.F. sharp cut-off pentode	6.3	0.3	300,000	7.5	250	250	B7G
Z719	R.F. sharp cut-off pentode	6.3	0.3	400,000	7.4	300	300	B9A
***B309**	Double triode	6.3 12.6	0.3 0.15	10,000	5.5	300	—	B9A
B719	R.F. double triode ...	6.3	0.435	9,700	5.9	300	—	B9A

* The popular circuit for the registered UNIVERTER was designed by IKOPATENTS around **Osram Valves.**

Data Sheets on all these Valves are obtainable from the Osram Valve and Electronics Dept.

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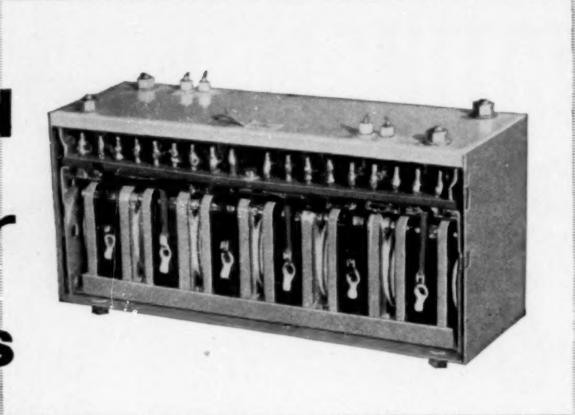

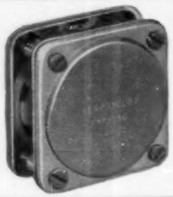

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WIRELESS ENGINEER

The Journal of Radio Research and Progress

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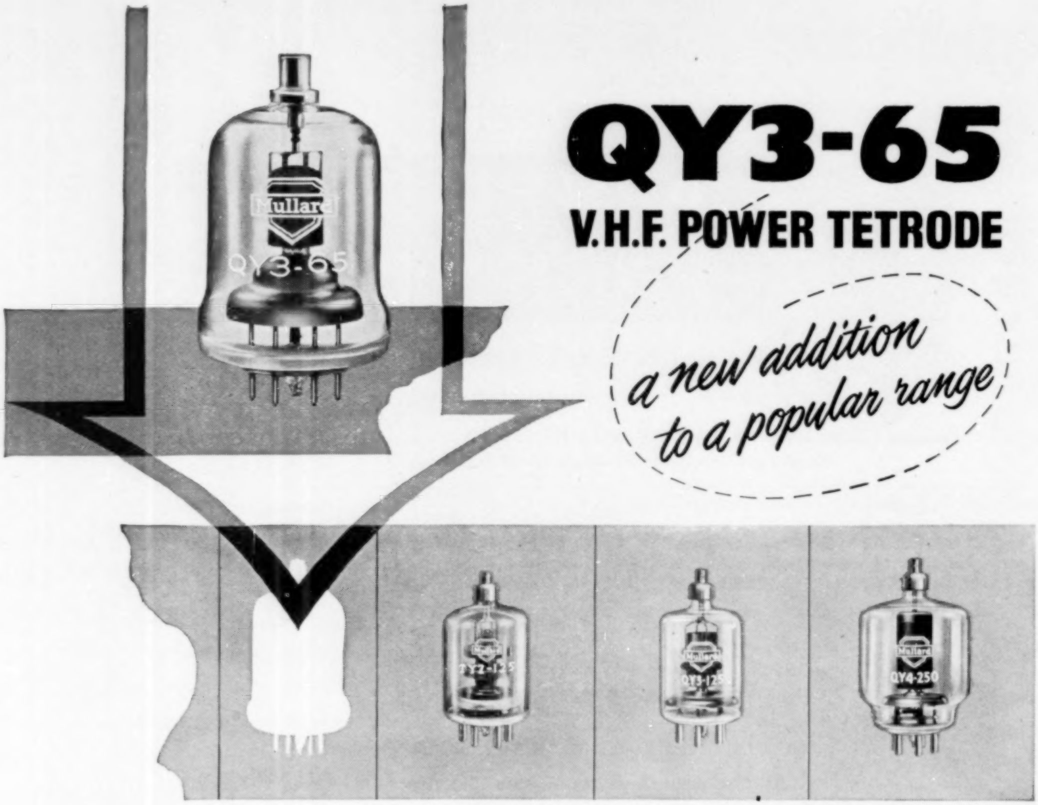
QY3-65

V.H.F. POWER TETRODE



This new tetrode, the QY3-65, embodies a similar technique and construction to the Mullard range of all-glass transmitting valves which are already well established in communications and industry. It has an anode dissipation of 65 watts and a maximum frequency of 250 Mc/s and is directly interchangeable with the American 4-65A.

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QY3-65 (CV1905)	**TETRODE**	**3000**	**-100**	**115**	**10**	**170**	**224**	**81**	**250**
TY2-125 (CV1924)	TRIODE	2500	-200	205	40	390	310	76	200
QY3-125 (CV2130)	TETRODE	3000	-150	167	6.5	300	300	75	200
QY4-250 (CV2131)	TETRODE	4000	-225	312	9	374	800	80	120

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WIRELESS ENGINEER

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Television Sync-Pulse Spectrum

IT is often easier to perform calculations on non-sinusoidal waveforms with the aid of operational calculus than to use the Fourier-series method with steady-state a.c. theory. It is not surprising, therefore, that the Fourier method should be falling out of favour. However, it can still be very helpful. It is often desirable to know the frequency spectrum of a wave even if one does not employ it for actual calculation and even if one does not know the actual amplitudes of the various frequencies.

A simple qualitative approach, or several such approaches made in different ways, will often reveal useful information very quickly and easily. Many people are deterred from attempting to find the Fourier series for complicated waveforms by the laboriousness of the ordinary methods. We want to point out that it is often possible to avoid these methods by using a few well-known series and adding or multiplying them.

We shall illustrate the procedure by finding the series for the British television sync-pulse waveform, illustrated at Fig. 1(a). Space does not permit us to draw the complete waveform for one complete cycle at picture frequency. We have shown 15 lines only and there are 390 others in

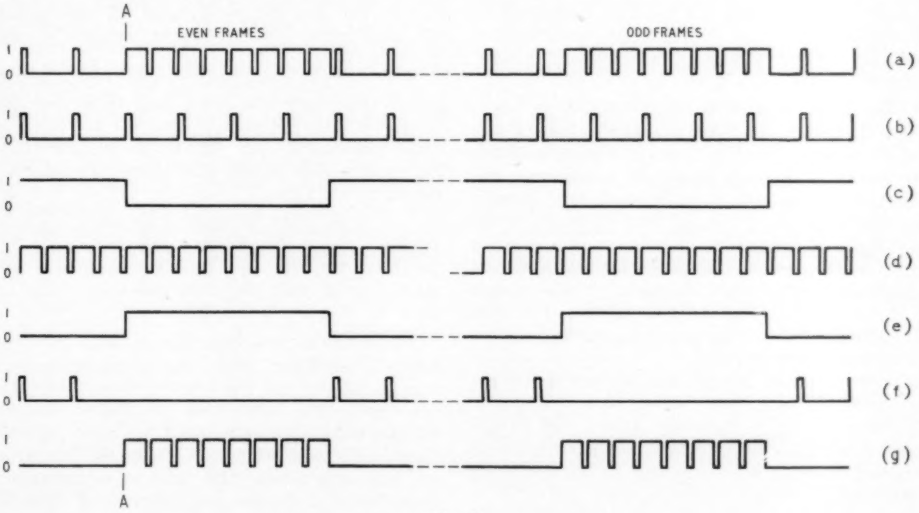

Fig. 1.

the central gap; they are, however, identical with the initial lines on the left.

The first step is to consider how one could generate such a waveform. One would obviously start by generating a simple line-frequency pulse waveform like (b). This agrees with (a) everywhere except during the frame pulses. The obvious next step is to suppress the line pulses during the frame-pulse periods and one could do this in a gating stage. One could, for instance, use a multi-electrode valve with the line pulses applied to one grid and frame-frequency pulses applied to another to cut it off during these pulses. Practically, there would be difficulties with such a simple gating circuit, but that does not affect our general argument. The required frame-frequency waveform would be like (c) and the resulting output would be like (f), a line-frequency pulse waveform with certain pulses suppressed.

In Fig. 1 we have shown the pulses as being of unit amplitude; the signal is either zero or unity. Waveform (f) can thus be produced by multiplying together waveforms (b) and (c). The Fourier series for (f) can thus be obtained by multiplying together the individual Fourier series for (b) and (c).

Now one cycle of waveform (b) is a simple rectangular wave like Fig. 2 and it is well known that its Fourier series is

$$S = a_0 + \sum_{1}^{\infty} a_n \sin n\omega t + \sum_{1}^{\infty} b_n \cos n\omega t \;.. \qquad (1)$$

where $\omega = 2\pi f = 2\pi/T$ and n is integral; the values of the coefficients a_0, a_n and b_n depend upon the value of τ/T, the fractional pulse width and the order n of the harmonic (Fig. 2).

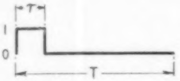

Fig. 2.

It should be noted that all the waves in Fig. 1 have a transition at AA. A single cycle of any wave is therefore like Fig. 2 or its inverse and this must be taken into account in evaluating the coefficients a_0, a_n and b_n. We shall not attempt this evaluation here.

We shall designate the various series by the letter S with a subscript letter according to the fundamental recurrence frequency. The series for (b) is thus S_l and is equation (1) with $\omega = \omega_l = 2\pi$ times the line frequency and the appropriate coefficients.

Waveform (c) is the inverse of waveform (e). Now the series for (e) is S_f and is clearly identical with (1) with $\omega = \omega_f = 2\pi$ times the frame frequency and the appropriate coefficients. It is clear, too, that (c) is $1 - S_f$ and so the series for waveform (f) is

$$S_l(1 - S_f)$$

We have now to produce a waveform to fill the gaps in (f). By arguing on the same lines as before, we can clearly do this by generating (d) of twice the line frequency and gating it with (e) to produce (g). We then get (a) by adding (f) and (g).

The basic series for (d) is (1) with $\omega = 2\omega_l = 2\pi$ times twice the line frequency. However, (d) is inverted compared with the wave which (1) represents so the series is

$$1 - S_{2l}$$

The gating waveform is S_f and so the series corresponding to (g) is

$$S_f(1 - S_{2l})$$

The complete series representing (a) is thus

$$\begin{aligned} &S_l(1 - S_f) + S_f(1 - S_{2l}) \\ &= S_f + S_l - S_f(S_l + S_{2l}) \end{aligned}$$

We can at once see the form of the spectrum of (a). First of all, there is the frame frequency of 50 c/s and all its harmonics. Then there is the line frequency of 10·125 kc/s and all its harmonics.

The term $S_l + S_{2l}$ represents line frequency and all harmonics plus twice line frequency and all harmonics. However, S_{2l} and its harmonics coincide with the even harmonics of line frequency, so that $S_l + S_{2l}$ represents S_l with modified amplitudes of even harmonics. The spectrum of $S_l + S_{2l}$ is thus the same as that of S_l.

Now $S_f(S_l + S_{2l})$ is the product of a series in ω_f with a series in ω_l and produces terms like $\sin \omega_f t \sin \omega_l t$. These terms can be split into sum and difference form and so the full spectrum of $S_f(S_l + S_{2l})$ is of the form $nf_l \pm mf_f$. In other words, the line frequency and its harmonics are all modulated by the frame frequency and its harmonics.

The complete frequency spectrum thus comprises the frame frequency and all its harmonics, plus the line frequency and all its harmonics, plus sidebands (of frame frequency and all its harmonics) to the line frequency and all its harmonics. Thus,

50, 100, 150, 200, 250, etc. . . . c/s
10,125 ± 50, 100, 150, 200, 250, etc. . . . c/s
20,250 ± 50, 100, 150, 200, 250, etc. . . . c/s
30,375 ± 50, 100, 150, 200, 250, etc. . . . c/s
etc.

Since 10,125 is a multiple of 50/2, all the sidebands associated with the even harmonics of line frequency and the even harmonics themselves coincide with harmonics of frame frequency. All the sidebands associated with odd harmonics, the odd harmonics themselves and the fundamental of line frequency fall mid-way between the harmonics of frame frequency and thus 25 c/s from them.

It is thus possible for a component frequency of 25 c/s to appear, although the lowest fundamental frequency is 50 c/s! It appears as a sideband of the line frequency. Harmonic number 202 of 50 c/s is 10,100 c/s and produces sidebands of 10,125 ± 10,100 c/s to the line frequency fundamental. The lower sideband is 25 c/s.

We can say, therefore, that the complete frequency spectrum may comprise all integral multiples of 25 c/s.

Since we have not investigated the amplitudes of the terms, we cannot say anything about their relative importance. Since some frequencies are produced in several different ways, there is a possibility of one method of production cancelling another and so some frequencies of the spectrum may be missing.

The amplitudes of the terms in the basic series (1) fall off fairly rapidly with order of harmonic. The predominating terms in the complete series are thus likely to be those involving fundamentals of low-order harmonics in simple combination. The main terms are thus likely to be the frame frequency and its first few harmonics, the line frequency and its first few harmonics, and the low-order sidebands attached to these.

The presence of the 25-c/s component in the spectrum may seem a little odd and, because its production involves the 202nd harmonic of frame frequency, one is tempted to consider it as negligibly small. However, one could have predicted its presence by inspection of Fig. 1, for the waveform repeats itself precisely only every two frames. At the beginning and end of the frame pulses there are differences between odd and even frames brought about by the non-integral relation of line and frame frequencies.

When the frame pulses are separated from the line pulses before they are applied to synchronize the frame time-base, some methods result in there being a difference of waveform between odd and even frames at the end of the pulses. Patchett[1] has shown that it is this which accounts for many, if not most, difficulties in obtaining good interlacing. These differences necessarily imply the presence of a 25-c/s component.

It is easy to show that two successive frame scans must be alike within 1 part in 4,000 if interlacing is not to be appreciably affected. An error of 50 μsec in the timing will destroy the interlace and, as the frame period is 20 msec, this is an error of 1 part in 400. The 25-c/s component of the sync-pulse waveform thus does not need to be very large to affect matters.

The waveform of Fig. 1(a) is not, of course, applied in this form to the time-base for synchronizing. It is always operated on in some way first. If an integrator is used its effect will be to emphasize the relative amplitude of the 25-c/s component.

There is also a form of flywheel synchronizing for a line time-base in which the complete sync-pulse waveform is applied to a resonant circuit which is supposed to select only the line-frequency component and provide a sine-wave output. By the selectivity of the circuit, noise and interference are substantially removed and the sine wave is used, after suitable treatment, to control the time-base.

This circuit has been analysed on a pulse-response basis[2] and it has been shown that, unless the resonant circuit is extremely selective, the output wave is seriously affected by the frame pulses. This seems rather surprising at first, because one tends to think loosely of the line pulses only, and that the selectivity problem is only to separate the fundamental from the second and higher harmonics, which is a fairly easy matter.

When we think of the true spectrum, however, we can see right away that the sidebands of frame frequency and its harmonics will have a profound influence. To extract a pure sine wave, the circuit must be selective enough to pass 10,125 c/s while excluding frequencies 50 c/s higher and lower!

W.T.C.

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[1] G. N. Patchett, "Faulty Interlacing", *Wireless World*, July and August 1952, pp. 250 and 315.

[2] P. A. Neeteson, "Television Receiver Design", Monograph 2, "Flywheel Synchronization of Saw-Tooth Generators". (Philips' Technical Library, Cleaver Hume Press.)

RADIATION CHARACTERISTICS OF AXIAL SLOTS ON A CONDUCTING CYLINDER

By **J. R. Wait,** M.A.Sc., Ph.D.

(Radio Physics Laboratory, Defence Research Board, Ottawa, Ontario, Canada)

SUMMARY.—An extensive set of radiation patterns is presented for a narrow axial slot on a circular conducting cylinder of infinite length with a circumference up to 21 wavelengths. The results are also applicable to arrays of axial slots with an arbitrary distribution of transverse voltage. The effect of finite slot width is discussed and the external conductance of the slot is also considered.

Introduction

THE slotted cylinder aerial has been discussed in the literature quite extensively in the last decade[1-7]. In its simplest form it consists of a narrow axial slot of rectangular shape cut in the wall of a hollow metal cylinder. The slot is fed either by a transmission line inside the cylinder or by a waveguide. For most of the early applications the diameter of the cylinder was small compared to a wavelength and the radiation pattern is essentially omnidirectional in the equatorial plane. Sinclair[3] has shown that for an axial slot the pattern becomes more directive as the diameter of the cylinder is increased. Further computed curves of radiation patterns have been published by Silver and Saunders[7] for slotted-cylinders whose circumferences are 0·8 and 2·5 wavelengths and by Bailin[8] for circumferences of 8 and 12 wavelengths.

It is the purpose of this paper to present rather extensive calculations of radiation patterns of an axial slot on a circular cylinder with a circumference ranging from 0·1 to 21 wavelengths. It is shown that the results are also applicable to arrays of axial slots on the surface of the cylinder.

Cylinder Space Factor

The cylinder of radius a is shown in Fig. 1 and is taken to be coaxial with a cylindrical co-ordinate system (ρ, ϕ, z). A slot extends from z_1 to z_2 and from ϕ_1 to ϕ_2 on the surface of the cylinder $(\rho = a)$. It will be assumed that the slot is excited by a transverse voltage $V(z)$ which is to be specified. It then follows (see appendix) that the radiated field at large distances from the cylinder can be written, with reference to spherical co-ordinates (r, θ, ϕ), as follows:—

$$E_\phi = \frac{e^{-jkr}}{r} S(\theta)\, M(ka \sin\theta, \phi - \phi_0) \quad \ldots \quad (1)$$

and

$$H_\theta = -E_\phi/120\pi \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

MS accepted by the Editor, February 1955

where

$$S(\theta) = \frac{k \sin\theta}{2} \int_{z_1}^{z_2} V(z) e^{jk\cos\theta z}\, dz \quad \ldots \quad (3)$$

$$M(x, \phi) = \frac{1}{\pi^2 x} \sum_{m=0}^{\infty} \frac{\epsilon_m e^{jm\pi/2} \cos m\phi}{H_m^{(2)\prime}(x)} G_m \quad (4)$$

$k = 2\pi/$free-space wavelength,

$\epsilon_0 = 1,\ \epsilon_m = 2 (m \neq 0),$

$\phi_0 = (\phi_2 + \phi_1)/2,$

$G_m = \dfrac{\sin[m(\phi_2 - \phi_1)/2]}{m(\phi_2 - \phi_1)/2},$

and $H_m^{(2)\prime}(x)$ is the derivative of the Hankel function.

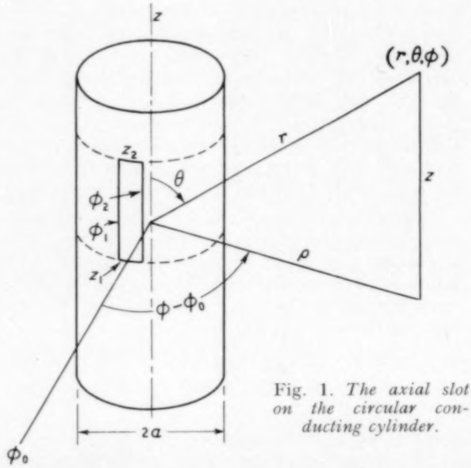


Fig. 1. *The axial slot on the circular conducting cylinder.*

The function $S(\theta)$ is the space factor of the slot or an array of collinear slots if they were cut in an infinite plane conducting sheet. For example, for a thin half-wave resonant slot (i.e., $kz_2 = -kz_1 = \pi/2$) centre fed by a voltage V_0, the voltage $V(z)$ is known to vary nearly sinusoidally along its length such that[9]

$$V(z) \approx V_0 \sin(\pi/2 - k\,|\,z\,|)$$

and therefore, as is well known,

$$S(\theta) = V_0 \frac{\cos\frac{\pi}{2}\cos\theta}{\sin\theta} . \qquad \ldots \qquad \ldots \qquad (5)$$

For slots of arbitrary length the functional form of $V(z)$ is not usually sinusoidal and depends on the method of excitation. For present purposes it is not necessary to specify $V(z)$.

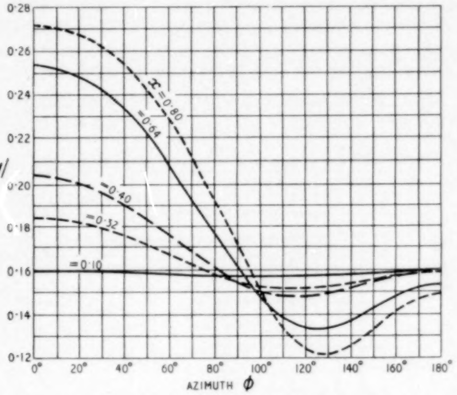


Fig. 2. *Amplitude of cylinder space factor for various values of $x = ka \sin\theta$.*

The function $M(x, \phi)$ can be called the 'cylinder space-factor' as it fully describes the effect of the finite diameter of the cylinder on the radiation pattern in both the θ and ϕ directions. When the slots are thin, so that $\phi_2 - \phi_1$ is small, the factor G_m can be replaced by unity. The nature of this approximation can be best examined by a numerical test. For the moment, however, it will be assumed that it is valid. For purposes of computation the 'cylinder space-factor' is written

$$M(x, \phi) = |\,M(x, \phi)\,|\, e^{j\alpha(x,\phi)}$$

$$= \frac{1}{x\pi^2} \sum_{m=0}^{\infty} \frac{\epsilon_m e^{j(m+1)\pi/2} \exp.\,[\,j\delta_m' x]\cos m\phi}{C_m'(x)} \qquad \ldots \qquad \ldots \qquad \ldots \qquad (6)$$

where C_m' and δ_m' are extensively tabulated[10] and defined by

$$H_m^{(2)\prime}(x) = -\,jC_m'(x)\exp. -[\,j\delta_m' x] .$$

Curves of the function $|\,M\,|$ and α are illustrated in Figs. 2 and 3 for x varying from 0·10 to 0·80. The abscissa needs to be shown only from 0° to 180° as M is an even function about $\phi = 0$. It can be seen from these curves that for very small values of x the pattern is omnidirectional. In fact, it is easy to show from equation (6) that

$$M(x, \phi)\Big]_{x \to 0} = (1/2\pi)\, e^{j\pi/2} .$$

For larger values of x the convergence of the series formula for M becomes poor and something of the order of $2x$ terms are required to acquire three-figure accuracy. Another difficulty is that the Bessel functions are not adequately tabulated for large arguments and order. In this case it is necessary to employ recursion formulae to extend the tables slightly. Values of $|\,M(x, \phi)\,|$ are shown plotted in Fig. 4 for x ranging from 1·0 to 21. The curves are displaced in the vertical direction to avoid any troublesome overlapping and to facilitate interpolation. To assist in reading the vertical scale, values of the ordinate $|\,M\,|$ are shown at appropriate places on the individual curves.

The nature of the curves is very interesting. As would be expected, the field in the geometrical shadow ($\phi > 90°$) becomes successively smaller for increasing values of x. Furthermore, it can be seen that the ripples for the larger x values have a period of approximately $180/x$ degrees and the amplitude of the ripples is at a maximum at the back of the cylinder.

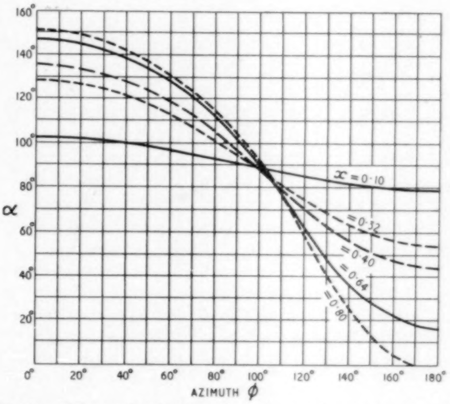


Fig. 3. *Phase of cylinder space factor for various values of $x = ka \sin\theta$.*

The phase function $\alpha(x, \phi)$, as would be expected, is a rapidly varying function of ϕ for the larger x values. For this reason, it is desirable to express the phase as the sum of a simple, rapidly varying, function and a slowly varying part $\Delta(x, \phi)$ which is defined by

$$\alpha(x, \phi) = \alpha(x, 0) - 57{\cdot}3\, x(1 - \cos\phi) + \Delta(x, \phi)$$

degrees for $\phi \leqslant 90°$ and

$$\alpha(x, \phi) = \alpha(x, 0) - x(57{\cdot}3 + \phi - 90°) + \Delta(x, \phi)$$

for $90° \leqslant \phi \leqslant 180°$. $\qquad \ldots \qquad \ldots \qquad \ldots \qquad (7)$

The function $\Delta(x, \phi)$ is plotted in Fig. 5 for x ranging from 1·0 to 21. Again for convenience of presentation and for ease of interpolation, the curves are displaced vertically. The reference phase $\alpha(x, 0)$ which is usually not of any consequence is given in the following short table for sake of completeness.

x	1·0	1·5	2·0	3·0	4·0	6·0
$\alpha(x, 0)$	159·2°	188·9°	213·3°	268·8°	324·8°	78·1°
x	8·0	10·0	12·0	15·0	18·0	21·0
$\alpha(x, 0)$	191·7°	305·0°	59·9°	232·0°	42·5°	214·5°

It can be noted that the phase correction is small on the front face of the cylinder. On the back face it is somewhat larger. In any case, by employing the appropriate value of $\Delta(x, \phi)$ the actual phase function $\alpha(x, \phi)$ can be computed simply from equation (7).

From the standpoint of geometrical optics it would be expected that $|M(x, \phi)|$ would be constant on the front face and that $\Delta(x, \phi)$ would be zero. It is seen from the curves that for larger values of x these conditions are being at least reasonably satisfied. Furthermore, geometrical optics would predict that $|M(x, \phi)|$ would be vanishingly small for directions toward the back face. The phase from the geometrical optics concept would seem to be indeterminant. From a physical optics standpoint, however, it would be expected that the phase would be somewhat characteristic of a wave travelling from the slot around the periphery of the cylinder with a velocity near that of free space. The departure from such a simple behaviour is evident from examining the function $\Delta(x, \phi)$ for $\phi > 90°$.

The physical interpretation of the ripples in both the amplitude and phase curves is that the

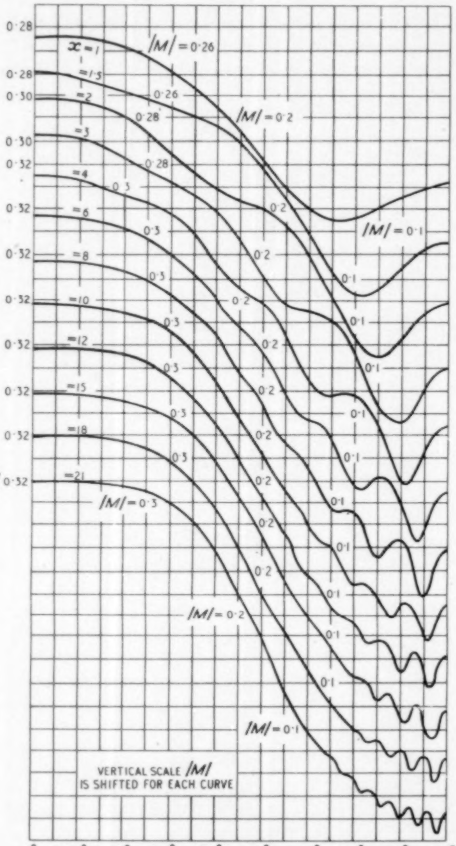


Fig. 4. *Amplitude of cylinder space factor for narrow axial slot.*

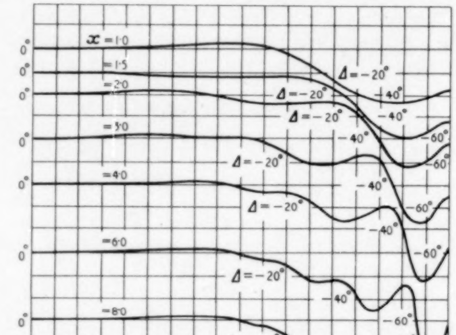


Fig. 5. *Phase of cylinder space factor for narrow axial slot.*

radiation from the slot travels around the periphery of the cylinder in both directions. At the back face of the cylinder the two waves interfere to form a standing-wave pattern. The larger the cylinder is in terms of wavelength, the greater the attenuation of these peripheral surface waves and hence the smaller the amplitude of the ripples in the radiation pattern.

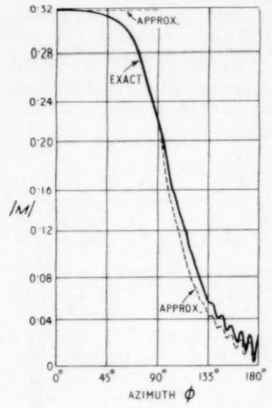
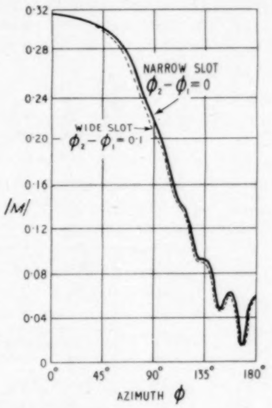


Fig. 6. *Cylinder space factor for $x = ka \sin \theta = 21$.*

Fig. 7 (below). *Cylinder space factor for $x = ka \sin \theta = 8$.*



This physical description actually has a theoretical basis as has been pointed out by Franz and Depperman[11]. They have shown, by an integral equation formulation for the reciprocal problem of a plane wave incident on a cylinder, that the infinite series solution in equation (4) can be approximated as follows:—

$$(2/j\pi x)\, M(x, \phi) \approx 2e^{jx \cos \phi} \text{ for } \phi < 90^\circ \quad \ldots \quad \ldots \quad \ldots \quad (8a)$$

$$\approx \left(\frac{1{\cdot}39}{2\pi}\right) \frac{A(\phi - \pi/2)e^{-jx(\phi - \pi/2)} + A(3\pi/2 - \phi)e^{-jx(3\pi/2 - \phi)}}{1 - A(2\pi)e^{-j2\pi x}} \quad \ldots \quad (8b)$$

for $90^\circ \leqslant \phi \leqslant 180^\circ$.

The function $A(\phi)$ is given by

$$A(\phi) = \exp\left[- \alpha e^{-j\pi/6} (x/24)^{\frac{1}{3}} \phi \right] \quad \ldots \quad (9)$$

with

$$\alpha = 2{\cdot}332\, e^{-j\pi/3} + 0{\cdot}4196 x^{-\frac{2}{3}}\,.$$

This expression is claimed to be valid for $x \gg 1$. As an interesting comparison $M(x, \phi)$, computed from this formula is calculated for $x = 21$ and compared with the curve computed from the exact series formula. The results plotted in Fig. 6 show that the agreement is only fair even for values of x as large as 21. Nevertheless, the formula of Franz and Depperman is useful to compute $M(x, \phi)$ for values of x larger than 21 where the amount of computation in evaluating the series formula would be prohibitive. Furthermore, it is clear that the terms in the numerator of equation (8b) have the nature of peripheral surface waves travelling in opposite directions around the cylinder. The denominator, according to Franz and Depperman, is a factor to account for multiple excursions of these surface waves completely around the cylinder.

Effect of Slot Width

In the previous calculations the slot has been assumed to be of infinitesimal width. To illustrate the effect of the finite width of slot, computations of $M(x, \phi)$ were carried out for a slot whose angular width is 0·1 radian with $x = 8$. Since $\phi_2 - \phi_1 = 0{\cdot}1$ the coefficient G_m in equation (4) is given by

$$G_m = \frac{\sin (m/20)}{(m/20)}$$

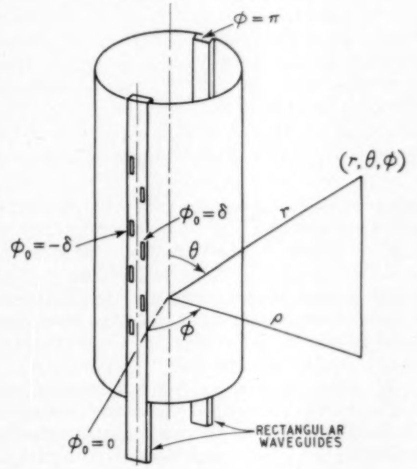


Fig. 8. *Two arrays of waveguide-fed slots on cylinder.*

The results of this calculation are shown in Fig. 7 along with the corresponding curve for the infinitely-narrow slot. It can be seen that the effect of slot width is indeed very small. In this case the actual width of the slot is 0·13 wavelength. It is, therefore, probably safe to assume that if the width of the slot is less than about one-tenth of a wavelength, the radiation pattern is characteristic of a very narrow slot with the same voltage distribution throughout its length.

Arrays of Slots

The numerical results shown graphically in Figs. 2 to 6 can be readily applied to arrays of axial slots on the cylinder. An example is two identical arrays of waveguide-fed slots located on opposite faces of the cylinder as shown in Fig. 8. The centre lines of these arrays are located at $\phi_0 = 0$ and $\phi_0 = \pi$. In each case the slots are alternately displaced on either side of the centre lines. The amount of offset is dictated by the nature of the desired form of the radiation pattern in the θ direction[9]. In most cases it can be assumed that each array of displaced slots is equivalent to a parallel line of narrow collinear slots. The two arrays are then represented by four lines of axial slots located in azimuth at $\phi_0 = \pm\delta$ and $\phi_0 = \pi \pm \delta$ where δ is the mean offset of the slots from the centre line of the arrays.

The azimuthal pattern $M_a(x, \phi)$ of this double array of slots on the cylinder is determined entirely by the function $M(x, \phi)$ and is, therefore, not dependent on $S(\theta)$ the space factor of the arrays. In fact, it follows that

$$\begin{aligned} M_a(x,\phi) = {} & [M(x,\phi+\delta) + M(x,\phi-\delta)] \\ & \pm [M(x,\phi+\pi+\delta) + M(x,\phi+\pi-\delta)] \quad \ldots \quad (10) \end{aligned}$$

where the + sign is to be used when the arrays are fed in phase and the − sign when they are fed out of phase. The function $|M_a(21, \phi)|$ for $\delta = 2{\cdot}0°$ is plotted on a relative decibel scale in Figs. 9 and 10 for both the in-phase and the out-of-phase connection. Only one quadrant need be shown since $M_a(x, \phi)$ is an even function about the 90° points.

W. Searle and R. G. Sinclair have supplied us with some azimuthal patterns measured at X-Band for an 8-in. diameter metal cylinder with a double array of axial slots with a mean offset corresponding to $\delta \approx 2{\cdot}0°$. The angle θ was kept constant at 80·5° so $x = ka \sin\theta = 20{\cdot}96 \approx 21$*.

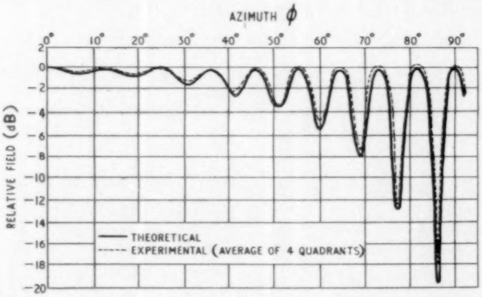


Fig. 9. *Pattern for two slot arrays on cylinder fed in phase ($ka \sin\theta = 21$).*

The experimental data for the four quadrants was averaged and is shown plotted in Figs. 9 and 10 along with the theoretical curves. The agreement is very good and so it can be considered a good check on the data for $|M(x, \phi)|$ and $\alpha(x, \phi)$ in Figs. 4 and 5. As a matter of interest, it might be mentioned that the computations for $|M_a(x, \phi)|$ were first carried out under the assumption that the slot offsets need not be considered so far as the azimuthal pattern was concerned. This is equivalent to setting $\delta = 0$ in equation (10). The calculations showed that this approximation led to errors of several decibels in the azimuth pattern although the nulls are located in the same place.

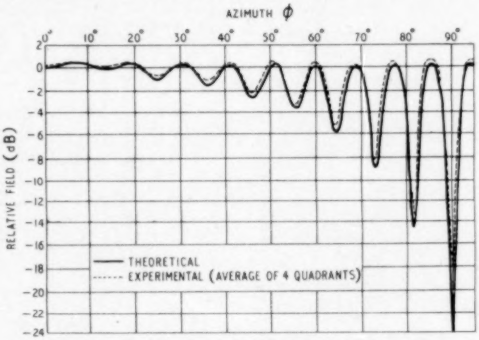


Fig. 10. *Pattern for two slot arrays on cylinder fed out of phase ($ka \sin\theta = 21$).*

Conductance of a Slot on a Cylinder

To conclude this discussion some mention should be made of the input conductance of slots on circular cylinders. To treat this problem fully and rigorously would require a very exhaustive analysis. Only the exterior problem is considered here; that is, if the voltage across the slot is specified, how much power is radiated into the space exterior to the cylinder? Furthermore, the slot is taken to be a narrow half-wave resonant axial slot with a sinusoidal voltage distribution. The radiation field is then given by

$$E_\phi = \frac{e^{-jkr}\, V_0 \cos\left(\dfrac{\pi}{2}\cos\theta\right)}{\pi^2\, rk \sin^2\theta\, a} \sum_{m=0}^{\infty} \frac{\epsilon_m j^m \cos m\phi}{H_m^{(2)\prime}(ka \sin\theta)} \quad \ldots \quad (11)$$

The time-averaged Poynting vector $\vec{S}$ is then

$$\vec{S} = \frac{1}{2} \text{ Real Part of } \vec{E} \times \vec{H}^* \quad \ldots \quad (12)$$

where the asterisk denotes the complex conjugate. In the radiation field, the Poynting vector has only a radial component S_r so that

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*The arrays were designed to produce a main lobe at the angle $\theta = 80{\cdot}5°$ neglecting diffraction around the cylinder.

$$S_r = \frac{1}{\eta_0} E_\phi E_\phi^* \quad .. \quad .. \quad .. \quad .. \quad (13)$$

for r tending to infinity. The radiated power P is then obtained, in the usual way, by integrating over a spherical surface. This leads to

$$P = \frac{1}{2\eta_0}\int_0^\pi \int_0^{2\pi} \frac{V_0^2 \cos^2\left(\frac{\pi}{2}\cos\theta\right)}{r^2\pi^4k^2 \sin^4 \theta a^2}$$

$$\times \sum_{n=0}^{\infty}\sum_{m=0}^{\infty} \frac{\epsilon_n \epsilon_m e^{j\pi/2(n-m)} \cos n\phi \cos m\phi\, r^2 \sin\theta\, d\theta d\phi}{[H_n^{2\prime}]\,[H_m^{2\prime}]^*} \quad .. \quad (14)$$

which, following an integration with respect to ϕ, takes the form

$$P = \frac{V_0^2}{2\eta_0\pi^3 k^2a^2}\int_0^\pi \frac{\cos^2\left(\frac{\pi}{2}\cos\theta\right)}{\sin^3\theta} \sum_{n=0}^{\infty} \frac{2\epsilon_n}{|H_n^{2\prime}(ka\sin\theta)|^2} d\theta \,. \quad (15)$$

The external radiation conductance G is then defined by

$$G = 2P/V_0^2.$$

Employing numerical integrations of equation (15), values of G were computed for various ka values between 0·1 and 21. The limiting value for very small cylinders is seen from equation (15) to be given by

$$G = \frac{60}{\eta_0^2}\int_0^\pi \frac{\cos\left(\frac{\pi}{2}\cos\theta\right)}{\sin\theta} d\theta\,, \quad .. \quad (16)$$

which is the same integral that arises in a thin half-wave wire aerial[12]. The radiation conductance for infinitesimally small cylinders is then given by

$$G]_{ka\to 0} = 73{\cdot}13/\eta_0^2 = 0{\cdot}514 \text{ milli-mho},$$

where it will be immediately recognized that the 73·13 can be identified with the radiation resistance in ohms of the complementary wire aerial. This simple equation is a statement of Babinet's principle. At very large values of ka the cylinder, so far as the slot is concerned, is equivalent to an infinite plane conducting surface. Following the reasoning of Booker[13] it would be expected that

$$G]_{ka\to\infty} = 2 \times 73{\cdot}13/\eta_0^2 = 1{\cdot}028 \text{ milli-mho}.$$

Employing these limiting values of G and the intermediate computed values, a curve G is drawn as a function of ka from 0 to ∞ as shown in Fig. 11.

This curve would indicate that the external conductance of the slot is a varying function of the diameter of the cylinder. Furthermore, if the circumference of the cylinder is greater than about 10 wavelengths the conductance is within 10% of the conductance of the same slot on an infinite flat ground plane.

Conclusion

It is believed that the results given will be useful in the design of slotted-cylinder aerials. The curves of the 'cylinder space factor' are presented in a form in which they should have wide applicability.

Acknowledgments

I would like to thank Messrs. R. M. Dohoo, W. Searle and R. G. Sinclair for making available their experimental results and for their helpful comments. Mr. W. A. Pope and Miss M. O'Grady assisted with the numerical work and helped to prepare the illustrations.

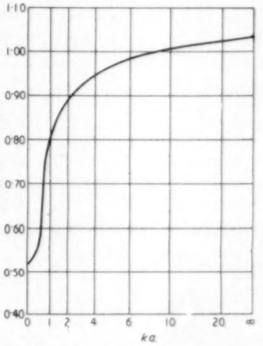

Fig. 11. *External conductance of a narrow half-wave resonant slot on a cylinder.*

ADDENDUM *

The external conductance values presented in the paper have been checked experimentally by D. G. Frood and K. W. Armstrong of the Radio Physics Laboratory. Briefly the measuring technique consisted of feeding a single resonant axial slot on the cylinder by an X-band rectangular waveguide in a manner similar to that illustrated in Fig. 8. In the present case it was convenient to mount the waveguide so that the narrow face of the guide was essentially flush with the inner surface of the cylinder. The quantity measured was the equivalent shunt conductance g of the slot in the narrow face of the waveguide normalized to the characteristic admittance of the guide. This is related to the external or aperture conductance G in milli-mhos by

$$g = \frac{480}{73\pi}\frac{b_1}{b_2}\frac{\lambda_g}{\lambda}\cos^2\frac{(\pi\lambda)}{2\lambda_g}\frac{1{\cdot}03}{G}$$

where b_1 and b_2 are the inner dimensions of the broad and narrow faces of the guide, respectively, and λ and λ_g are the free-space and guide wavelengths, respectively. The above formula is obtained by a direct extension of Stevenson's analysis[15] for the case where the longitudinal slot is in the narrow face of the guide which is flush with an infinite flat metal plate. This is

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equivalent to an infinitely large cylinder ($ka \rightarrow \infty$) where $1{\cdot}03/G$ in the above formula would tend to unity.

In the experiment, $\lambda = 3{\cdot}2$ cm, $\lambda_g = 4{\cdot}48$ cm, $b_1 = 0{\cdot}9$ inches, $b_2 = 0{\cdot}4$ inches, and therefore $g = 1{\cdot}28/G$.

The dimensions of the slot were 2/3 in. × 1/16 in. Denoting Δg as the difference between g for arbitrary ka and g for $ka = \infty$, the comparison between theory and experiment is shown in the following table:

Δg Values

ka	2·5	3	5	7	9	14
Experiment	0·13	0·09	0·06	0·05	0·05	0·02
Theory	0·15	0·12	0·08	0·05	0·04	0·02

The agreement here is quite reasonable. The departure at the smaller ka values can probably be accounted for by the non-resonant condition of the slot in which case g and G would not be inversely proportional.

The effect of the finite length of the cylinder was also investigated experimentally. It was found that the measured conductance was essentially independent of length L if $L > 3a$.

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APPENDIX

Although the derivation of the expression for the radiation field of an axial slot is implicit in the previously-mentioned papers, it seems worth while for the sake of completeness to outline a proof. Furthermore, the method used here does not rely on the use of the reciprocity theorem and therefore is of general interest.

The starting point is to consider a magnetic dipole of moment Kdz_0 where dz_0 is the equivalent length of the element of magnetic current K as defined by Schelkunoff[14]. With respect to the (ρ, ϕ, z) co-ordinate system, the dipole is located at (ρ_0, ϕ_0, z_0) and is oriented in the z direction. The surface of the conducting cylinder of infinite length is defined by $\rho = a$ where $a \leqslant \rho_0$.

The primary magnetic vector potential of the dipole has only a z component F_p and is given by

$$F_p = \frac{Kdz_0 e^{-jkr_1}}{4\pi r_1} \qquad \text{.. \quad .. \quad ..} \quad (1A)$$

where

$$r_1 = [\rho_1^2 + (z - z_0)^2]^{\frac{1}{2}}$$

and

$$\rho_1 = [\rho^2 + \rho_0^2 - 2\rho\rho_0 \cos(\phi - \phi_0)]^{\frac{1}{2}} .$$

The resultant potential has only a z component F and is a solution of the inhomogeneous Helmholtz wave equation

$$(\nabla^2 + k^2) F = -\frac{Kdz_0\,\delta(r - r_0)}{4\pi} \qquad \text{.. \quad ..} \quad (2A)$$

where r and r_0 are vectors extending from the origin to the point of observation and the source points respectively. $\delta(r - r_0)$ is the three-dimensional impulse function. The resultant fields are given by

$$E_\rho = -\frac{1}{\rho}\frac{\partial F}{\partial \phi}, \quad E_\phi = \frac{\partial F}{\partial \rho}, \quad E_z = 0,$$

$$j\mu\omega H_\rho = \frac{\partial^2 F}{\partial \rho \partial z}, \; j\mu\omega H_\phi = \frac{\partial^2 F}{\rho \partial \phi \partial z}, \; j\mu\omega H_z = \left(k^2 + \frac{\partial^2}{\partial z^2}\right) F. \qquad \text{.. \quad .. \quad ..} \quad (3A)$$

The function F must now be constructed so as to be a solution of the inhomogeneous wave equation and to satisfy the boundary condition that the tangential electric field (i.e., E_ϕ) vanishes on the conducting surface, that is

$$\frac{\partial F}{\partial \rho} = 0 \text{ at } \rho = a.$$

The function F is now expressed as a combined Fourier integral and series as follows

$$F(\rho, \phi, z) = \frac{1}{2\pi}\int_{-\infty}^{+\infty} e^{-jh(z-z_0)} \sum_{m=0}^{\infty} \epsilon_m F_m(\rho) \frac{1}{2\pi} \cos m(\phi - \phi_0) \qquad \text{.. \quad .. \quad ..} \quad (4A)$$

where F_m is a Fourier coefficient which is a solution of the equation

$$\left[\frac{\partial}{\partial \rho}\, \rho\, \frac{\partial}{\partial \rho} + (k^2 - h^2)\rho - \frac{m^2}{\rho}\right] F_m(\rho) = -\delta(\rho - \rho_0). \qquad \text{.. \quad .. \quad ..} \quad (5A)$$

Solutions of equation (5A) which possess a vanishing normal derivative at $\rho = a$ are

$$F_m(\rho) = C_m H_m^{(2)}(u\rho)\left[J_m(u\rho_0) - \frac{H_m^{(2)}(u\rho_0)}{H_m^{(2)\prime}(ua)} J_m'(ua)\right] \text{for } \rho > \rho_0$$

$$= C_m H_m^{(2)}(u\rho_0)\left[J_m(u\rho) - \frac{H_m^{(2)}(u\rho)}{H_m^{(2)\prime}(ua)} J_m'(ua)\right] \text{for } \rho < \rho_0 \qquad \text{.. \quad .. \quad ..} \quad (6A)$$

where $u = (k^2 - h^2)^{1/2}$, J_m is the Bessel Function of the first type of order m and $H_m^{(2)}$ is the Hankel function of the second kind of order m. The factor C_m can be found by integrating, with respect to ρ, both sides of equation (5A) over a small interval which includes ρ_0. This process yields

$$C_m = -j\pi/2.$$

The resultant magnetic vector potential is then completely given by

$$F = -\left(\frac{Kdz_0}{4\pi}\right)\frac{j}{2}\sum_{0}^{+\infty}\epsilon_m \cos m(\phi - \phi_0) \times \int_{-\infty}^{+\infty} H_m^{(2)}(u\rho)\left[J_m(u\rho_0) - H_m^{(2)}(u\rho_0)\frac{J_m'(ua)}{H_m^{(2)\prime}(ua)}\right]e^{-jh(z-z_0)}dh \quad .. \quad (7A)$$

for $\rho > \rho_0$. The solution for the case $\rho < \rho_0$ is obtained by interchanging ρ and ρ_0 where they occur in equation (7A). This constitutes the exact solution for the problem of a magnetic dipole parallel to a circular conducting cylinder. Since this result has not apparently been given elsewhere, it is of some interest in its own right.

The above formal solution is simplified somewhat if the fields are observed at a large distance from the cylinder. The square bracket term in the integral is then a slowly varying function of h compared to the other factors. The saddle point of the integrand is then at $h = k \cos \theta$ where $\theta = \tan^{-1} \rho/(z - z_0)$. The integration can then be carried out to yield

$$F \approx \frac{Kdz_0}{4\pi}\frac{e^{-jkR}}{R}\sum_{m=0}^{\infty}\epsilon_m e^{jm\pi/2} \cos m(\phi - \phi_0)e^{jkz_0 \cos\theta}\left[J_m(k\rho_0 \sin \theta) - H_m^{(2)}(k\rho_0 \sin \theta)\frac{J_m'(ka \sin \theta)}{H_m^{(2)\prime}(ka \sin \theta)}\right] \quad .. \quad (8A)$$

where $R = (\rho^2 + z^2)^{1/2}$ and which is valid for $k\rho \sin \theta \gg 1$. To the same order of approximation, the fields are given by $E_\phi \approx -jk \sin \theta F$ and $H_\theta \approx -\dfrac{k}{\mu\omega} E_\phi$. The other field components are of order $1/R^2$ so they can be neglected in the far field.

When the magnetic current element is located on the surface of the cylinder ($\rho_0 = a$), the radiation field can be written

$$E_\phi = \frac{Kdz_0 e^{jk\cos\theta z_0} e^{-ikR}}{a\pi^2 R}\sum_{m=0}^{\infty}\frac{\epsilon_m \cos m(\phi - \phi_0)e^{jm\pi/2}}{H_m^{(2)\prime}(ka \sin \theta)} \quad .. \quad .. \quad .. \quad (9A)$$

where use has been made of the Wronksian relation

$$H_m^{(2)}(\alpha)\, J_m'(\alpha) - H_m^{(2)\prime}(\alpha)\, J_m(\alpha) = 2j/\pi\alpha.$$

By employing Schelkunoff's equivalence theorem[14] it can be seen that the axial magnetic current K at z_0 is equivalent to a thin axial slot on the cylinder of length dz_0 excited by a transverse voltage $V(z_0)$. The extension to an axial slot of finite length from z_1 to z_2 is effected by integrating over z_0. Furthermore, if the slot is of finite width the integration must also be carried out over ϕ_0 from ϕ_1 to ϕ_2. It is assumed here, for convenience, that the transverse field in the slot is uniform. It then follows that

$$E_\phi = \frac{e^{-jkR}}{2\pi^2 aR}\int_{z_1}^{z_2} V(z_0)e^{jk\cos\theta z_0}\,dz_0$$

$$\times \sum_{m=0}^{\infty}\frac{\sin[m(\phi_2 - \phi_1)/2]}{[m(\phi_2 - \phi_1)/2]}\,\frac{\epsilon_m e^{jm\pi/2}\cos m(\phi - \phi_0)}{H_m^{(2)\prime}(ka \sin \theta)} \quad (10A)$$

where $\phi_0 = (\phi_2 + \phi_1)/2$.

EQUIVALENT EQUALIZER NETWORKS

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1. Introduction

WHERE a signal suffers attenuation and phase distortion, equalizers are inserted in the circuit to correct for either or both forms of distortion. Instead of obtaining the full amount of correction with one complex network it is often more convenient to synthesize the required characteristic from those of simpler networks. This may be done in two distinct ways.

(a) The normal procedure is to use constant-resistance networks connected in tandem. This method has the advantage that if the attenuation–frequency response of the simple networks have been calculated in dB and graphs drawn, the end-to-end response is the sum of the individual curves.

(b) An alternative method is to connect a number of very simple circuits (such as differentiating circuits) in tandem, pass the signal through such an arrangement and combine the signals which appear at the various junctions—including the input—in varying proportions as shown in the block schematic diagram of Fig. 1. The overall response will then be the algebraic sum of the individual responses calculated on a linear basis. This method was suggested by Gouriet[1] and for certain applications it has special advantages, in particular, extreme flexibility. The various types of frequency-response curves obtainable with practical networks of this kind will now be analysed and the equivalent constant-resistance networks derived for comparison since the performance of these latter networks is well known. In the analysis which follows, the symbol p will be used throughout for $j\omega$.

2. Equalizer of the 1st Order

Either of the two differentiating circuits of Fig. 2 may be used. Both give the same result, viz.:

$$\frac{V_2}{V_1} = \frac{pL_2}{R_1 + pL_2} = \frac{p}{p + 1/T} \text{ where } 1/T = \frac{R_1}{L_2}$$

$$\text{and } \frac{V_2}{V_1} = \frac{R_2}{R_2 + 1/pC_1} = \frac{p}{p + 1/T} \text{ where } T = R_2C_1$$

Equalization is achieved by combining the

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differentiated voltage with the input voltage in the correct proportion. Using the notation of Fig. 1.

$$V_0 = K_1 V_1 \pm K_2 V_2$$

for a first-order equalizer. Since we are not concerned with changes in absolute level but only with changes in frequency response, the two constants K_1 and K_2 may be replaced by one without loss of generality so long as the one constant is suitably chosen. If we let

$$V_0 = aV_1 \pm (1 - a)V_2$$

where $0 \leqslant a \leqslant 1$

we see that this equation satisfies our requirement because the ratio of a to $(1 - a)$ can vary between 0 and ∞. Again, writing the equation in this form ensures that the output cannot exceed the input. It is therefore equivalent to a passive network.

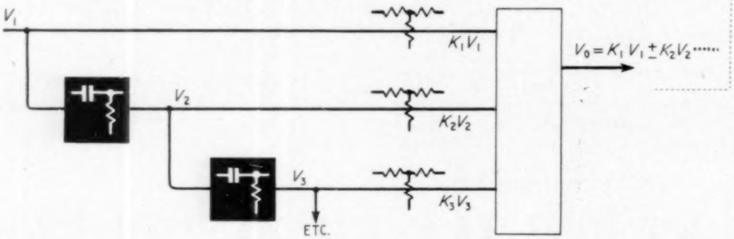


Fig. 1. *Derivative equalizer.*

The various types of responses possible with this equalizer will now be calculated.

The response is given by the ratio of output voltage to input voltage. Taking the positive sign first we have

$$\frac{V_0}{V_1} = \frac{aV_1 + (1 - a)V_2}{V_1}$$

$$= a + (1 - a)V_2/V_1$$

$$= a + \frac{(1 - a)p}{p + 1/T}$$

$$= \frac{ap + a/T + p - ap}{p + 1/T}$$

$$= \frac{p + a/T}{p + 1/T} \quad \cdots \quad \cdots \quad \cdots \quad (1)$$

In a constant-resistance equalizer, such as the bridged-T circuit of Fig. 3, the voltage ratio is given by the well-known formula

$$\frac{V_0}{V_1} = \frac{Z_2}{R + Z_2} \quad \cdots \quad \cdots \quad \cdots \quad (2)$$

and if the shunt arm Z_2 consists of a resistance r in series with an inductance L then

$$\frac{V_0}{V_1} = \frac{r + pL}{R + r + pL} = \frac{p + r/L}{p + (R + r)/L} \quad \cdots \quad (3)$$

Equations (1) and (3) will be identical when

$$r/L = a/T, \text{ and } (R + r)/L = 1/T$$

from which

$$r/(R + r) = a$$

alternatively, $r = Ra + ra$

$$\text{giving } r = \frac{Ra}{1 - a}$$

$$\text{and } T = \frac{(1 - a)L}{R}$$

If next we take the negative sign, we get that,

$$\frac{V_0}{V_1} = \frac{aV_1 - (1 - a)V_2}{V_1}$$

$$= \frac{ap + a/T - p + ap}{p + 1/T}$$

$$= \frac{(2a - 1)p + a/T}{p + 1/T} \quad \cdots \quad (4)$$

For this negative sign there are two possibilities. When $\frac{1}{2} < a$, or $1 < 2a$, then $0 < 2a - 1$. Alternatively when $a < 1$, or $2a < 1 + a$, then $2a - 1 < a$.

Therefore in the range $\frac{1}{2} < a < 1$ it follows that $0 < 2a - 1 < a$, and so that the expression may be rewritten as follows

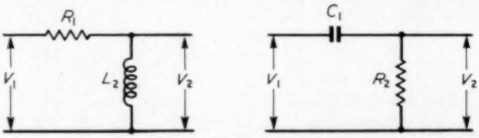


Fig. 2. *Differentiating circuits.*

$$\frac{V_0}{V_1} = a \,.\, \frac{(2a - 1)Tp/a + 1}{pT + 1} \quad \cdots \quad (5)$$

The multiplier a represents constant attenuation and as it does not affect the frequency response it may be neglected. The remainder of the expression will then be identical with equation (3) provided pL is replaced by $1/pC$; i.e., with the equation

$$\frac{V_0}{V_1} = \frac{rCp + 1}{(R + r)Cp + 1} \quad \cdots \quad (6)$$

Equating coefficients in (5) and (6) we have

$$(2a - 1)T/a = rC$$

and $T = (R + r)C$

$$\therefore \frac{2a - 1}{a} = \frac{rC}{(R + r)C} = \frac{r}{R + r}$$

or $2(R + r)a - (R + r) = ra$

$$(2R + r)a = R + r$$

$$\text{giving } a = \frac{R + r}{2R + r}$$

In this case the attenuation–frequency curve slopes in the opposite direction to that obtained by adding the voltages.

However, when $0 < a < \frac{1}{2}$, then $2a - 1$ is negative and equation (3) may be rewritten,

$$\frac{V_0}{V_1} = \frac{a/T - (1 - 2a)p}{1/T + p} = \frac{a - (1 - 2a)pT}{1 + pT}$$

multiplying numerator and denominator by $a + (1 - 2a)pT$, we get

$$\frac{V_0}{V_1} = \frac{a + (1 - 2a)pT}{1 + pT} \cdot \frac{a - (1 - 2a)pT}{a + (1 - 2a)pT}$$

The first expression corresponds to the characteristics of one of the two constant-resistance equalizers already discussed depending upon the relative values of a and $(1 - 2a)$.

If $a > 1 - 2a$ (i.e., $a > 1/3$) the attenuation increases with frequency.

If $a < 1/3$, the attenuation decreases with frequency, while if $a = 1/3$, the attenuation is constant. In the second expression the modulus of the numerator is equal to that of the denominator and so it represents a network which gives a phase change with no attenuation. This can be produced by a constant-resistance lattice section having series and lattice arms consisting of an inductor and a capacitor respectively, where $L = RT$, and $C = T/R$, R being the image impedance of the lattice.

3. Equalizer of the 2nd Order

If the differentiated voltage V_2 is passed through a second differentiating circuit, the output voltage V_3 will be given by,

$$\frac{V_3}{V_2} = \frac{p}{p + 1/T_2} = \frac{p}{p + S_2} \text{ (where } S = 1/T\text{)}$$

$$\frac{V_3}{V_1} = \frac{V_2}{V_1} \cdot \frac{V_3}{V_2} = \frac{p}{p + S_1} \cdot \frac{p}{p + S_2}$$

$$= \frac{p^2}{(p + S_1)(p + S_2)}$$

And if $V_0 = K_1 V_1 \pm K_2 V_2 \pm K_3 V_3$

(the K terms being positive fractions)

$$\text{Then } \frac{V_0}{V_1} = K_1 \pm K_2 \frac{V_2}{V_1} \pm K_3 \frac{V_3}{V_1}$$

$$= K_1 \pm \frac{K_2 p}{p + S_1} \pm \frac{K_3 p^2}{(p + S_1)(p + S_2)}$$

$$= \frac{K_1(p + S_1)(p + S_2) \pm K_2 p(p + S_2) \pm K_3 p^2}{(p + S_1)(p + S_2)}$$

which may be written

$$\frac{V_0}{V_1} = \frac{a(p^2 + bp + c)}{(p + S_1)(p + S_2)} \quad \ldots \quad \ldots \quad (7)$$

Where $a = K_1 \pm K_2 \pm K_3$

$b = (K_1S_1 + K_1S_2 \pm K_2S_2)/(K_1 \pm K_2 \pm K_3)$

and $c = K_1S_1S_2/(K_1 \pm K_2 \pm K_3)$

It will be seen that all values are possible for b and c and so the quadratic in the numerator of equation (7) is perfectly general. If it is capable of being factorized it may be rewritten as follows, the factor a being ignored.

$$\frac{V_0}{V_1} = \frac{(p + \alpha_1)(p + \alpha_2)}{(p + S_1)(p + S_2)}$$

$$= \frac{p + \alpha_1}{p + S_1} \cdot \frac{p + \alpha_2}{p + S_2}$$

The equivalence of each part of this expression to the response of a constant-resistance equalizer network with or without a phase-shift network has already been established. The response corresponding to the whole expression will therefore be produced by these networks connected in tandem. It does not matter which value of α is associated with which S, the overall response will be the same although the individual networks used will vary with the combination chosen.

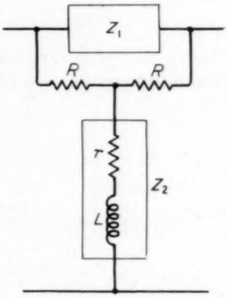


Fig. 3. *Bridged-T equalizer.*

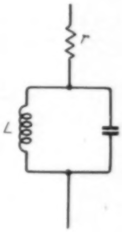


Fig. 4. *Shunt arm Z_2.*

A constant-resistance equalizer of the second order which is very commonly used is the resonant equalizer; that is, one in which the shunt arm, Z_2 of Fig. 3, consists of the circuit shown in Fig. 4.

Here we have,

$$Z_2 = r + \frac{pL}{(1 - p^2/p_0^2)}$$

where

$p_0^2 = -\omega_0^2 = -1/LC$

So that from (2), we find that,

$$\frac{V_0}{V_1} = \frac{r + pL/(1 - p^2/p_0^2)}{r + R + pL/(1 - p^2/p_0^2)}$$

Multiplying numerator and denominator by $(1 + p^2/p_0^2)$ this becomes,

$$\frac{V_0}{V_1} = \frac{r - rp^2/p_0^2 + pL}{(R + r) - (R + r)p^2/p_0^2 + pL} \quad \ldots \quad (8a)$$

$$= \frac{r}{(R + r)} \cdot \frac{p^2 - (p_0^2 L/r)p - p_0^2}{p^2 - (p_0^2 L/(R + r))p - p_0^2} \quad \ldots \quad \ldots \quad \ldots \quad (8b)$$

Comparing this with equation (7) we find that for the equations to be identical, the constant terms in the numerator and denominator of (7) must be equal,

$$\text{i.e., } \frac{K_1S_1S_2}{K_1 \pm K_2 \pm K_3} = S_1S_2 \quad .. \quad .. \quad (9)$$

$$\text{or} \qquad K_1 = K_1 \pm K_2 \pm K_3$$

$$\text{giving} \qquad K_2 = - K_3$$

Again, the coefficient of p in the numerator of equation (8b) is greater than that in the denominator.

Applying this condition to equation (7) we get that,

$$\frac{K_1S_1 + K_1S_2 \pm K_2S_2}{K_1 \pm K_2 \pm K_3} > S_1 + S_2$$

and making use of equation (9),

$$KS_1 + K_1S_2 \pm K_2S_2 > K_1S_1 + K_1S_2$$

Therefore the positive sign must be attached to K_2.

Again, the coefficient of p in the numerator of equation (8a), is equal to that in the denominator.

Applying this condition to equation (7), we get that

$$a \,.\, b = S_1 + S_2$$

$$\text{i.e., } K_1S_1 + K_1S_2 \pm K_2S_2 = S_1 + S_2$$

$$\text{i.e., } \pm K_2S_2 = (S_1 + S_2)\,(1 - K_1)$$

and since $K_1 < 1$, the negative sign on the left-hand side may be omitted.

$$\therefore K_2 = \frac{(S_1 + S_2)}{S_2}\,(1 - K_1) \quad .. \quad .. \quad (10)$$

The equivalent of the resonant equalizer is thus given by,

$$V_0 = K_1V_1 + \frac{S_1 + S_2}{S_2}(1 - K_1)\,(V_2 - V_3)$$

It remains to consider the case of the numerator of equation (7) having complex roots. There are two possibilities, firstly when b is positive and secondly when b is negative. Consider the constant–resistance equalizer circuit of Fig. 3, in which Z_2 consists of the configuration shown in Fig. 5.

The impedance of Z_2 is given by

$$Z_2 = Lp + R_3 + \frac{R_4/Cp}{1/Cp + R_4}$$

$$= Lp + R_3 + \frac{R_4}{1 + CR_4p}$$

$$= \frac{LCR_4p^2 + (L + CR_3R_4)p + (R_3 + R_4)}{1 + CR_4p}$$

Substituting for Z_2 in (2) we get

$$\frac{V_0}{V_1} = \frac{LCR_4p^2 + (L + CR_3R_4)p + (R_3 + R_4)}{LCR_4p^2 + (L + CR_3R_4 + CRR_4)p + (R_3 + R_4 + R)}$$

The values of the components L, C, R_3 and R_4 may always be chosen so that the roots of the numerator are complex; e.g., one way of doing this would be to make $L = CR_3R_4$.

$$\text{Then } (L + CR_3R_4)^2 - 4LCR_4(R_3 + R_4)$$

$$= 4C^2R_3{}^2R_4{}^2 - 4C^2R_3{}^2R_4{}^2 - 4C^2R_3R_4{}^3$$

$$= -4C^2R_3R_4{}^3$$

This is the condition for complex roots.

The condition for real roots in the denominator is that

$$(L + CR_3R_4 + CRR_4)^2 > 4LCR_4(R_3 + R_4 + R)$$

Since the expression on the left-hand side contains a term in R^2 whereas the highest power of R on the right-hand side is the first, the left-hand side increases with R more rapidly than the right. It is therefore mathematically possible to select values of R to satisfy the above condition. Practically of course, the circuit impedance R is fixed but the same result may be produced by decreasing L, C, R_3 and R_4 relative to R. This circuit is therefore the practical realization of equation (7) when the coefficient b is a positive number and the roots are complex.

If the equation turns out to be of the form,

$$\frac{V_0}{V_1} = \frac{a(p^2 - bp + c)}{(p + S_1)(p + S_2)}$$

it may be written,

$$\frac{V_0}{V_1} = \frac{a(p^2 + bp + c)}{(p + S_1)(p + S_2)} \cdot \frac{p^2 - bp + c}{p^2 + bp + c}$$

The network corresponding to the first term has already been obtained. The magnitude of the second term is unity since the modulus of the numerator is equal to that of the denominator. This term therefore represents a phase-shift network of the second order.

4. Equalizers of Higher Order

We have seen that the output to input voltage ratio of a first-order equalizer is the ratio of two polynomials of the first degree in p while for a second-order equalizer the polynomials are of the second degree. It can easily be verified that for an equalizer of order n, the polynomials will each be of degree n. The denominator may be factorized into terms corresponding to the differentiating circuits used, whereas the numerator will be perfectly general. Each of the real factors of the numerator may be associated with a factor in the denominator to represent the voltage ratio of a first-order equalizer. The complex roots of the numerator occur in complementary pairs and so these may be extracted as a quadratic factor associated with two from the denominator to represent the voltage ratio of a second-order equalizer. Equalizers of a higher order than the second do not therefore contribute a new type of characteristic but are equivalent to a number of first- and second-order equalizers connected in tandem.

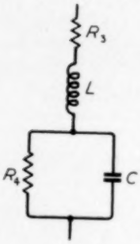


Fig. 5.
Shunt arm Z_2.

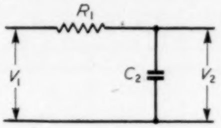


Fig. 6.
Integrating circuit.

5. Integrating Circuits

All the characteristics obtained with differentiating circuits may also be obtained with integrating circuits, for example, the integrating circuit of Fig. 6 gives the equation,

$$\frac{V_2}{V_1} = \frac{1/pC_2}{R_1 + 1/pC_2} = \frac{1}{R_1C_2p + 1}$$

$$= \frac{1}{p + 1/T} \quad \text{where } T = R_1C_2$$

and n such circuits will give

$$\frac{V_{n+1}}{V_1} = \frac{1}{(p + 1/T)^n}$$

Combining this with the input we get,

$$\frac{K_1V_1 \pm K_{n+1}V_{n+1}}{V_1} = \frac{K_1(p + 1/T)^n \pm K_{n+1}}{(p + 1/T)^n}$$

This is the ratio of two polynomials of degree n and the inclusion of the intermediate terms in the numerator can make this perfectly general.

6. Summary

The equivalence of the two methods of equalization has been demonstrated and the most important of the equivalent circuits are listed in tabular form.

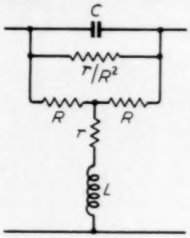
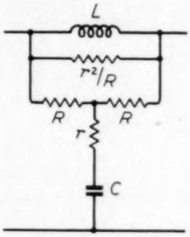
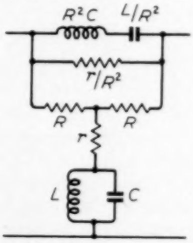
Acknowledgments

The author wishes to thank the British Broadcasting Corporation for granting permission to publish this article.

REFERENCE

[1] G. G. Gouriet, "Spectrum Equalization", *Wireless Engineer*, May 1953, p. 112.

TABLE

1st Order Constant Resistance	**Derivative**
	$V_0 = aV_1 + (1 - a)V_2$ where $0 < a < 1$ and $V_2 = \frac{pT}{pT + 1} V_1$
$r = \frac{Ra}{1 - a}$ $L = CR^2$ $= \frac{RT}{1 - a}$	$a = \frac{r}{R + r}$ $T = \frac{L}{R + r}$
	$V_0 = aV_1 - (1 - a) V_2$ where $\frac{1}{2} < a < 1$ and $V_2 = \frac{pT}{pT + 1} V_1$
$r = \frac{(2a - 1)}{1 - a} R$ $L = CR^2$ $= \frac{(1 - a)T}{a} R$	$a = \frac{R + r}{2R + r}$ $T = (R + r)C$
2nd Order Constant Resistance	**Derivative**
 R^2C L/R^2 r/R^2 R R r L C	$V_0 = K_1V_1 +$ $\frac{S_1 + S_2}{S_2} (1 - K_1) (V_2 - V_3)$ where $0 < K_1 < 1$ $V_2 = \frac{p}{p + S_1} V_1$ and $V_3 = \frac{p}{p + S_2} V_2$
$r = \frac{K_1}{1 - K_1} R$ $L = \frac{S_1 + S_2}{S_1S_2} \cdot \frac{R}{1 - K_1}$ $\omega_0 = \sqrt{S_1S_2}$ $C = \frac{1 - K_1}{S_1 + S_2} \cdot \frac{1}{R}$	$K_1 = \frac{r}{R + r}$ S_1 and S_2 $= \frac{1}{2}\omega_0\left\{\frac{\omega_0L}{R+r} \pm \sqrt{\left(\frac{\omega_0L}{R+r}\right)^2 - 4}\right\}$

SATURABLE-REACTOR FREQUENCY DIVIDER

By **G. W. G. Court***, B.Sc., A.M.I.E.E., A.Inst.P. and **C. I. C. Scollay**†, B.E., B.Sc., A.M.I.E.E.

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SUMMARY.—A saturable reactor in conjunction with a simple resistance-capacitance network will provide a frequency-dividing circuit capable of producing a pulse output at the frequency, or submultiple of the frequency, of an input sinusoidal voltage waveform.

The circuit was initially devised as a means of synchronizing the pulse repetition frequency of a radar modulator at half the power supply frequency but has other applications where frequency division of this kind is required.

General

THE saturable reactor is well known as a result of the original paper by Melville[1]; its essential characteristics may be briefly summarized by reference to Fig. 1 which shows the idealized form of the B–H characteristic of a magnetic material such as H.C.R. metal.

The initial part of the curve OS is linear and, following the sharp 'knee' at S, the characteristic ST remains parallel to the H axis. An inductor having a magnetic circuit of material of this type will have the following features.

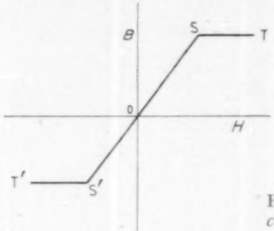

Fig. 1. *Idealized B-H curve of H.C.R. material.*

The incremental inductance when the core material is operated in the regions OS and OS′ will be constant and can be referred to as L_u. In the region ST and S′T′ the core material is saturated and the incremental inductance becomes L_s which approaches zero.

$$L_u \gg L_s$$

Now consider a network, Fig. 2, in which a saturable inductor L is associated with a resistance-capacitance combination R, C, and r which is a small resistance. The network is supplied by a voltage source $E\sin\omega t$ and we can consider the circuit CLr to be a resonant circuit at the supply voltage frequency; $L = L_u$. In this case the oscillatory current in it will build up if the supply voltage is suddenly applied.

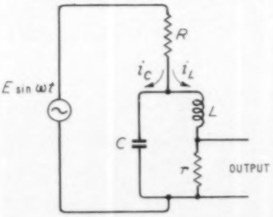

Fig. 2. *Frequency-dividing network.*

If i_C and i_L are the currents in the circuit branches as shown, we can derive a differential equation

$$\left[D^2 + \left(\frac{r}{L_u} + \frac{1}{CR}\right)D + \frac{R+r}{L_uCR}\right]i_L = \frac{E\sin\omega t}{L_uCR}$$

the solution of which contains a transient and a steady-state term.

By a suitable choice of constants the frequencies of the transient and steady-state terms can be made the same (i.e., the supply frequency) and by satisfying the conditions when $t = 0$, $i_L = 0$ and $di_L/dt = 0$ the complete solution is of the form

$$i_L = I\cos\omega t\,(1 - e^{-At})$$

where A is a constant depending on the parameters of the circuit and I is the maximum value of the steady-state current. The solution is shown in graphical form in Fig. 3. It will be seen that the current through the inductor, which is the resultant of the steady-state current and the transient current, has peaks which increase in amplitude, during the first few cycles. Consider the point P, which is at a time precisely two complete cycles of the supply waveform after $t = 0$.

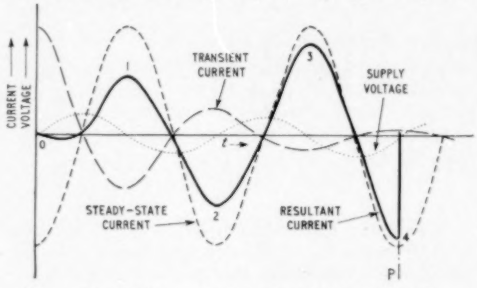

Fig. 3. *Theoretical waveforms in circuit of Fig. 2.*

As the current peaks are increasing in amplitude during this period it can be arranged that the value of current at point P is sufficient to increase the value of H in the inductor beyond the 'knee' of the B–H curve (Fig. 1), whereas earlier

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current peaks are such that H remains below the 'knee'. Thus at point P the circuit conditions change in that the value of inductance falls from L_u to L_s.

At resonance, the circuit CLr is a resistive impedance and the current through R is in phase with the supply voltage. Also the currents in the arms of the circuit i_L and i_C are in quadrature with the supply voltage. Thus when the current i_L reaches a maximum at P, the supply voltage is zero.

At P, the inductance L being part of the oscillatory circuit CLr, has a store of energy, and when L_u is replaced by L_s, this energy will be dissipated as a large current pulse through L_s and r. If the circuit losses were sufficiently small the circuit L_sCr would commence to oscillate at the appropriate frequency but, in fact, the losses are sufficient to prevent this and the energy is dissipated as a single pulse.

Now if the duration of this pulse is short compared with the period of the applied voltage waveform then immediately following it the conditions external to the circuit can be considered unchanged and we have the condition $i_L = 0$

and, since $E \sin \omega t = 0$, then $di_L/dt = 0$.

These are the conditions required at $t = 0$ for the solution of the differential equation discussed above.

So the process will be repetitive and a current pulse through r will occur at every second cycle of the supply voltage and will occur when this waveform passes through zero. Thus a voltage pulse output will be obtained across r at a repetition rate of half the frequency of the supply-voltage waveform. It will be superimposed on a small alternating voltage at the supply frequency.

With the set of constants considered, a frequency division by two has been achieved but, by suitable adjustment of values and Q of the circuit elements, it is apparent that division by other multiples is possible.

Practical Results

In practice, the circuit behaved generally according to the theoretical predictions although the core material used in the inductor did not have the ideal characteristics shown in Fig. 1. Particularly, the 'knee' of the curve was less well defined, and it was found that, due to this and the low Q of the circuit, the difference in amplitude of the third and fourth peaks of the current waveform was insufficient to ensure that the third was below the 'knee' and the fourth above it.

To overcome this difficulty, a d.c. bias winding was added to the inductor to shift the operating zone to one side of the H axis. It was so arranged that the third current peak was in opposition to the d.c. bias. Thus this peak was kept below the 'knee' of the characteristic but the fourth peak was well above it. There was sufficient difference between the second and fourth peaks to allow non-critical adjustment of the bias current to prevent saturation at the second peak of current.

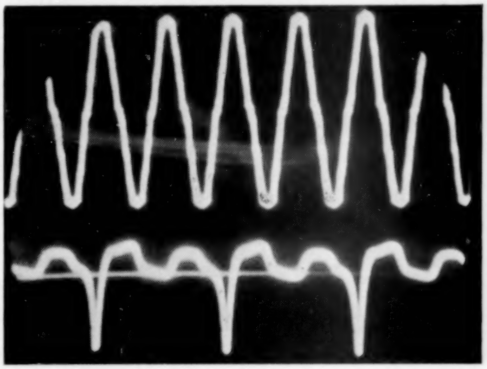

Fig. 4. *Input and output waveforms with 400-c/s supply.*

It was considered that an improvement in the performance of the saturable reactor, which could be obtained by the use of a toroidal core rather than the 'E' laminations used, would have obviated the need for a d.c. bias winding. However, it is possible that the variation in the division factor to be obtained by adjustment of current in a bias winding may be of some advantage in similar applications.

As might be expected from the theoretical treatment, and as can be visualized from the current waveforms, it is not essential for the transient waveform and the steady-state term to have precisely the same period. Adjustment of the value of C showed that the satisfactory operation could be obtained over a range of capacitance values.

A typical waveform obtained with a 400-c/s supply frequency is shown in Fig. 4. At a nominal supply voltage of 115 volts a variation of ± 5% had no adverse effect on the operation of the circuit.

Conclusion

The circuit described is a simple method of providing synchronizing pulses for a radar modulator at half the frequency of the power supply. Division by factors other than two is possible if required in other applications.

Acknowledgment

This paper is published with the permission of the Secretary of the Department of Scientific and Industrial Research, New Zealand.

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[1] W. S. Melville, *Proc. Instn elect. Engrs*, Part III, 1951, Vol. 98, p. 185.

GLOW-DISCHARGE STABILIZERS

Influence of some Tube Parameters on Impedance–Frequency Variations

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SUMMARY.—Measurements have been made to determine the influence of gas filling, gas pressure and direct operating current on the impedance–frequency characteristics of glow-discharge voltage-regulator tubes over the frequency range 20 c/s to 100 kc/s. Tubes with either nickel or cerium-alloy cathodes have been used for the investigations. The results of the work are presented here and discussed. It is concluded that helium-filled tubes should be employed for eliminating low-frequency ripple on the output voltage of a rectifier unit, but where the ripple possesses a high-frequency component, a neon-filled stabilizer should be used.

Introduction

IT is often desirable to operate electronic equipment from power supplies fed directly by the a.c. mains. The necessary d.c. supplies are usually obtained, therefore, from the mains through rectifier units, each of which incorporates a transformer, a rectifier and smoothing circuit. Large changes in the output voltage of such a rectifier unit are produced, however, by variations in mains voltage and load current and, in many cases, therefore, simple glow-discharge stabilizers are employed to keep the output voltages constant. Such a stabilizer should also reduce any ripple voltages present in the output of a power supply to which it is connected. This means that the internal impedance of the stabilizing tube for small alternating currents superimposed on the main direct current must be small, not only for low-frequency components, but also for high-frequency ones.

Further, where tubes are used as switching elements in series with audio-frequency telephone transmission circuits, the impedance presented to a.c. signals superimposed on the steady operating current may severely limit the usefulness of the tube, as pointed out by Townsend and Depp[1].

It has been found by several investigators that the a.c. impedance of a tube increases considerably with frequency[2–6]. Andrew[4] has drawn attention to the fact and mentions a few tests on 7475 and 85A1 commercial tubes over the frequency range 50–20,000 c/s. He also points out[7] that Iannone and Baller[8] have given information about the impedance of VR75, VR90, VR105 and VR150 tubes at frequencies up to 20 kc/s. Benson[9] has given a graph, taken from a previous publication[10], showing that the impedance of stabilovolts increases with frequency, although the upper limit of the graph is only 6 kc/s. Other interesting articles have been published by Hunt[5], Williams[6], Benson and Mayo[2,3], Townsend and Depp[1] and Groszkowski[11].

Hunt[5] explains that, although a glow-discharge tube is sometimes assumed to be equivalent to a constant voltage with a series resistor, in fact, due to gas ion-inertia effects, there is a quadrature component in the valve current when an alternating voltage is applied. He has given some typical resistance–frequency and inductance–frequency curves for a particular type of tube, with brief comments on them.

In their first article on this topic, Benson and Mayo[2] determined the variation of impedance with frequency over the range 20 c/s to 10 kc/s for the commercial tube types 85A1, 85A2, 7475 and S130. They confirmed previous measurements that the impedance increases with frequency. Further, it has been shown that the tubes all have surprisingly high values of inductance and appreciable values of effective resistance. In the second article Benson and Mayo[3] investigated the characteristics of 90C1, 150B2, QS70/20, QS75/60, QS83/3, QS92/10, QS105/45 and QS150/15 commercial types. It seemed from the results that the gas content of a tube is one factor which influences the shape of the impedance–frequency curve.

Groszkowski[11] has given two curves, one showing the inductance of a small neon tube as a function of the polarizing direct voltage and the other showing the inductance–frequency characteristics of the same tube. He has observed inductances of the order of several henrys.

The impedance of a tube, according to Townsend and Depp[1] varies with anode–cathode spacing. Further, an experimental plane-cathode tube was examined and compared with a commercial one having a smaller cathode area. The change of cathode area, together with the necessary change in anode geometry, led to a considerable impedance reduction. Townsend and Depp have also considered briefly the effects

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MS accepted by the Editor, February 1955

of varying a number of other parameters in a search for low impedance. They have shown that by proper correlation of cathode geometry and gas density, hollow cathode tubes can be used to obtain a negative-resistance component of impedance.

Williams[6] has made a number of tests determining the resistance and inductance variations with frequency in glow-discharge tubes. He discusses, in detail, the origin of the observed apparent inductance by considering the motion of a gas ion when acted on by an alternating field. He shows that while the damping effect produced by collision with other particles is analogous to a resistance the inertia due to the mass of the particle is analogous to an apparent inductance in the equivalent circuit. He could not, however, explain satisfactorily either the decrease of the apparent inductance at higher frequencies which had been observed by various previous investigators, or the resonant phenomenon which is observed at very high frequencies.

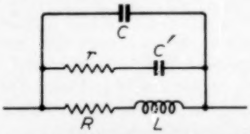


Fig. 1 (left). *Equivalent circuit for a glow-discharge tube.*

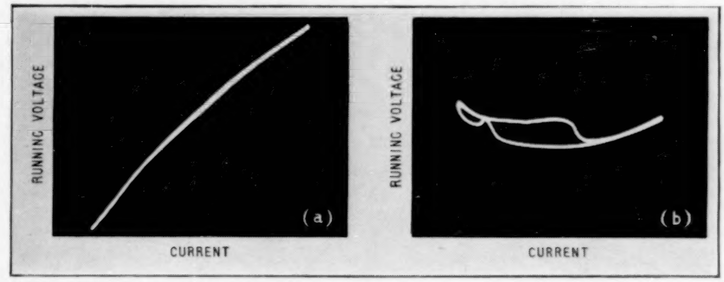


Fig. 2. (*a*) *Running-voltage/current characteristic of neon-filled glow-discharge tube and* (*b*) *helium-filled tube.*

The authors have now investigated, in detail, the variation of impedance with frequency of a large number of special experimental tubes, having either nickel or cerium-alloy* cathodes, containing different gas-fillings, at various gas pressures, in the range 20 c/s to 100,000 c/s. Further, the influence of the direct current through the tubes on the impedance has been observed. Particular attention has been paid to the values of impedance at high audio frequencies and frequencies up to 100,000 c/s. The results of the work are presented here and discussed.

Theory

A theory introduced by van Geel[12] and Verhagen[13] explains satisfactorily the phenomena which are observed in measuring impedance–frequency characteristics of glow-discharge tubes.

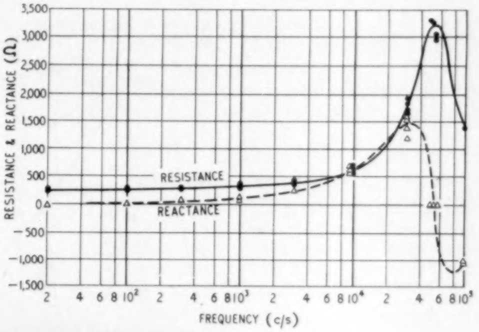
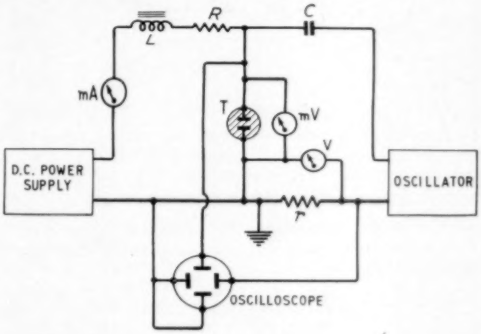


Fig. 3 (above). *Resistance and reactance as function of frequency; gas: neon/argon 99·33/0·67%; pressure* 40 *mm.*

Fig. 4 (below). *Simplified circuit diagram for impedance and phase-angle measurements on glow-discharge tube.*



Basically, the theory considers a space charge between the electrodes which is assumed to be a function of the voltage drop and the steady current of the tube. Any deviation from the steady current will produce a change in the space charge.

From these considerations the following differential equation is obtained connecting the current deviation i with the associated voltage deviation v:—

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*The alloy used consisted of 45% cerium, 45% iron, 5% of various rare earths and 5% of impurities. It is an alloy commonly called mischmetal.

$$Ri + L\frac{di}{dt} = v + (\tau + RC)\frac{dv}{dt} + LC\frac{d^2v}{dt^2} \qquad (1)$$

where R is the differential resistance of the tube
C is the total capacitance of the tube
L is a constant having the dimensions of inductance
τ is a constant having the dimensions of time.

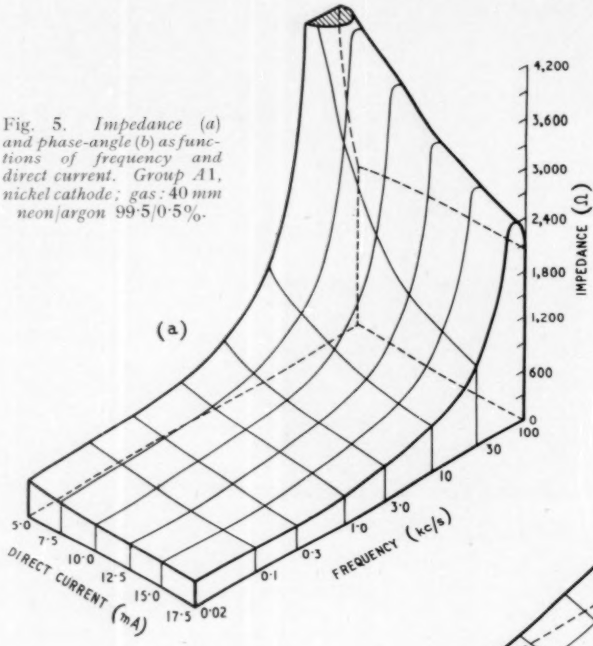


Fig. 5. *Impedance (a) and phase-angle (b) as functions of frequency and direct current. Group A*1, *nickel cathode; gas:* 40 *mm neon/argon* 99·5/0·5%.

It should be noted here that according to this theory L is not associated with inertia effects. From equation (1) the admittance of a tube for small sinusoidal alternating currents of frequency $f = \omega/2\pi$ superimposed on the steady current is obtained as:—

$$Y = \frac{1 + j\omega\tau}{R + j\omega L} + j\omega C \quad .. \quad .. \quad .. \quad (2)$$

The equivalent circuit of a glow-discharge tube is, therefore, not simply a resistor in series with an inductor, as is often assumed, but has a more complicated form as shown in Fig. 1. The two circuit elements $r = L/\tau$ and $C' = \tau/R$ are introduced instead of simply the time constant τ. It should be borne in mind that C' is an imaginary capacitance only and may be infinite or even negative. C, which is associated with the actual capacitance of the tube, is always positive.

Neglecting the capacitance of the tube the impedance:—

$$Z = \frac{R + j\omega L}{1 + j\omega\tau} \quad .. \quad .. \quad .. \quad (3)$$

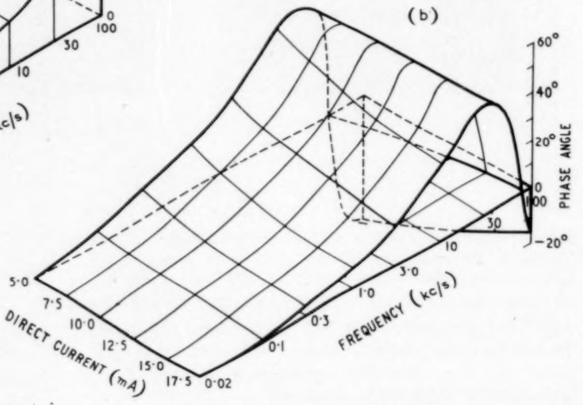
From this expression, as pointed out by van Geel, it is seen that:—

(1) The dynamic characteristic for very low frequencies is a straight line which coincides with the static running-voltage/current curve of the tube ($Z = R$).

(2) For the intermediate-frequency range the dynamic characteristic is a small ellipse (Z is inductive) and

(3) For high frequencies the dynamic characteristic is again a straight line but with a different slope from the low-frequency characteristic ($Z = L/\tau$).

If the tube capacitance is taken into account then it is found, from similar considerations, that the dynamic characteristic passes through all three stages mentioned above but becomes an ellipse again for very high frequencies and Z is capacitive.



It follows that some information about the differential impedance at low frequencies may be obtained from the form of the static running-voltage–current characteristic of the tube. For example, Fig. 2 shows that the static curves vary widely for tubes with different gas fillings, from which it is evident that at low frequencies the internal impedance of a helium-filled tube is much smaller than that of a neon tube. At high frequencies, however, the impedance depends mainly on the constants L and τ and it may differ very much from the impedance observed at low frequencies.

The above theory has been verified by the present measurements. A large number of different tubes have been tested and the impedance–frequency curves obtained are in complete agreement with the theory. This can be seen from the typical result of Fig. 3 showing the variations of resistance and reactance of a tube with frequency.

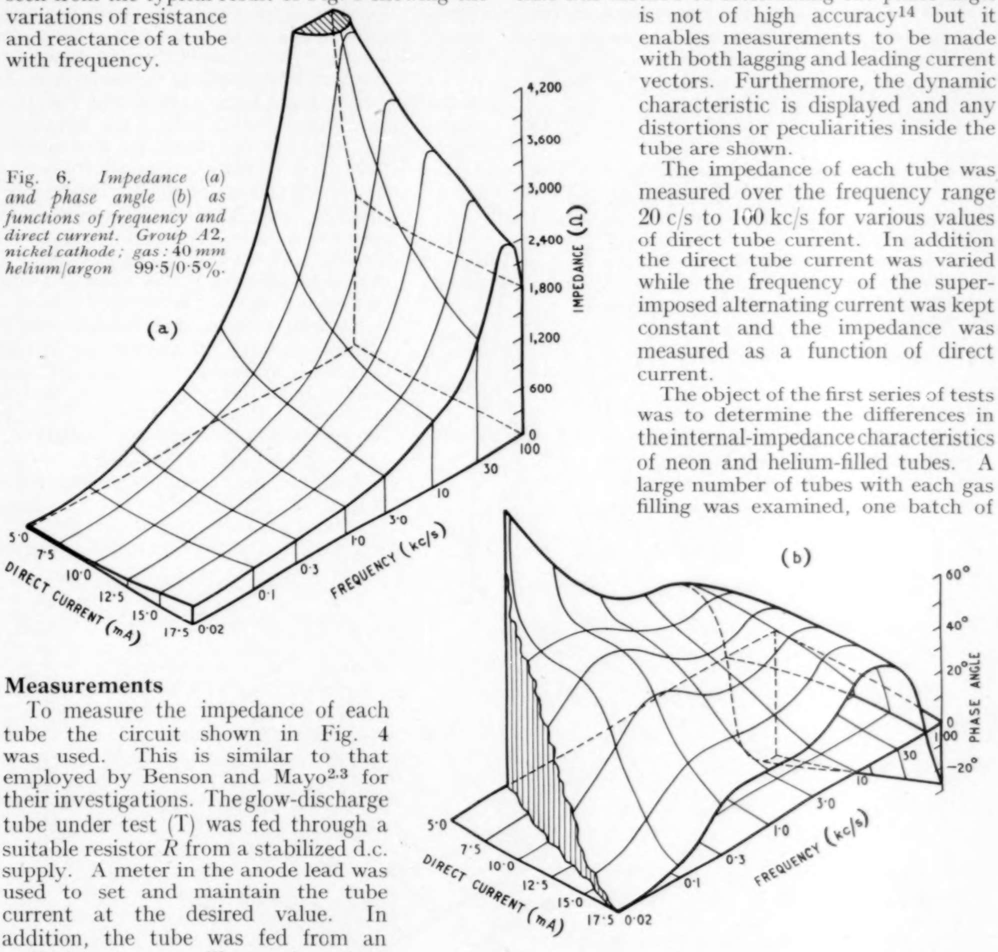


Fig. 6. *Impedance (a) and phase angle (b) as functions of frequency and direct current. Group A2, nickel cathode; gas: 40 mm helium/argon 99·5/0·5%.*

Measurements

To measure the impedance of each tube the circuit shown in Fig. 4 was used. This is similar to that employed by Benson and Mayo[2,3] for their investigations. The glow-discharge tube under test (T) was fed through a suitable resistor R from a stabilized d.c. supply. A meter in the anode lead was used to set and maintain the tube current at the desired value. In addition, the tube was fed from an audio-frequency oscillator through a very large blocking capacitor C. A valve voltmeter across the non-inductive resistor r was used to keep the superimposed alternating current at 1 mA. The alternating voltage drop across the tube was measured with the valve milli-voltmeter mV. The dropping resistor R was of large value so that its shunting effect across the tube could be neglected.

The alternating voltage and current were fed to the Y and X plates respectively of an oscilloscope. The phase-angle difference between the voltage and current was measured from the dynamic characteristic traced on the screen and the tube impedance was, in this way, split up into real and imaginary parts. It is understood that this method of determining the phase angle is not of high accuracy[14] but it enables measurements to be made with both lagging and leading current vectors. Furthermore, the dynamic characteristic is displayed and any distortions or peculiarities inside the tube are shown.

The impedance of each tube was measured over the frequency range 20 c/s to 100 kc/s for various values of direct tube current. In addition the direct tube current was varied while the frequency of the superimposed alternating current was kept constant and the impedance was measured as a function of direct current.

The object of the first series of tests was to determine the differences in the internal-impedance characteristics of neon and helium-filled tubes. A large number of tubes with each gas filling was examined, one batch of

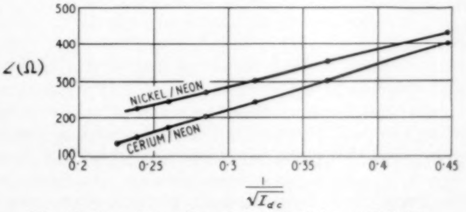


Fig. 7. *Impedance Z as function of d.c. at 1 kc/s;* $Z \propto 1/\sqrt{I_{dc}}$ *(I_{dc} measured in mA).*

tubes having nickel cathodes, another cerium-alloy cathodes.

The second series of tests was concerned with the influence of gas pressure on the impedance. For this purpose a number of tubes containing a 99·33/0·67% neon/argon mixture was examined. Tubes were made having gas pressures of 30, 35, 40, 45 and 50 mm of mercury.

Experimental Results

(a) Tubes with Different Gas Fillings

The mean results of the measurements on tubes with nickel cathodes and 99·5/0·5% neon/argon fillings are given in Fig. 5(a) and (b).

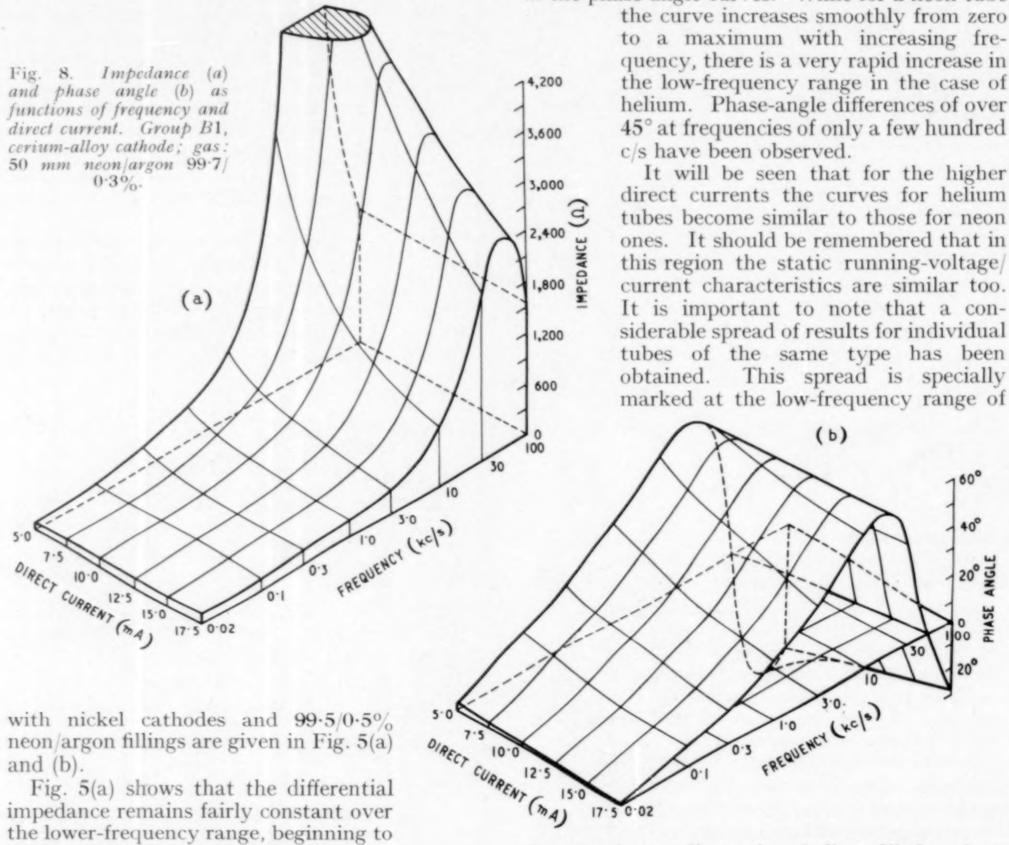


Fig. 8. *Impedance (a) and phase angle (b) as functions of frequency and direct current. Group B1, cerium-alloy cathode; gas: 50 mm neon/argon 99·7/0·3%.*

Fig. 5(a) shows that the differential impedance remains fairly constant over the lower-frequency range, beginning to increase only at about 3,000 c/s. Above this frequency the increase of impedance is rapid and maximum impedance occurs at the resonant frequency of about 50,000 c/s. At this point the phase-angle difference, which had been constantly increasing, drops back to zero as can be seen from Fig. 5(b). At frequencies above the resonant one the impedance falls off again and the phase-angle difference changes sign. Fig. 5(a) shows also that the impedance increases with decrease of steady tube current. This effect is only small for low frequencies but it increases when approaching the resonant frequency.

Figs. 6(a) and 6(b) give similar results for tubes with nickel cathodes and 99·5/0·5% helium/argon fillings. At low frequencies the impedance is much smaller for this type of tube than for those filled with neon. It increases rapidly, however, and at a frequency of 3,000 c/s the impedance is actually greater for a helium-filled tube than for a neon one. More obvious still is the difference in the phase-angle curves. While for a neon tube the curve increases smoothly from zero to a maximum with increasing frequency, there is a very rapid increase in the low-frequency range in the case of helium. Phase-angle differences of over 45° at frequencies of only a few hundred c/s have been observed.

It will be seen that for the higher direct currents the curves for helium tubes become similar to those for neon ones. It should be remembered that in this region the static running-voltage/current characteristics are similar too. It is important to note that a considerable spread of results for individual tubes of the same type has been obtained. This spread is specially marked at the low-frequency range of phase-angle readings for helium-filled tubes. Therefore Figs. 6(b) and 9(b) (which is discussed later) merely show the general shape of the characteristic but do not give an absolute measurement of the phase-angle difference.

It is evident from the various figures that the a.c. impedance/direct-current characteristic of a tube depends to a large extent on the frequency of the superimposed a.c. at which the measurements are made. Only in a limited number of cases can a simple relation be found between impedance and direct current. Tests made at a constant frequency of 1,000 c/s on 99·33/0·67% neon/argon-filled tubes having a cerium-alloy cathode and on 99·5/0·5% neon/argon tubes having a nickel cathode have shown that the impedance changes approximately inversely as the square root of the direct current through the tube as illustrated in Fig. 7. It is of interest to note that Townsend and Depp[1] have found that, at a fixed frequency, for a tube containing a 99/1% neon/argon mixture and having a cathode of barium and strontium oxides, the resistive component of impedance changes approximately inversely as the square root of the direct current.

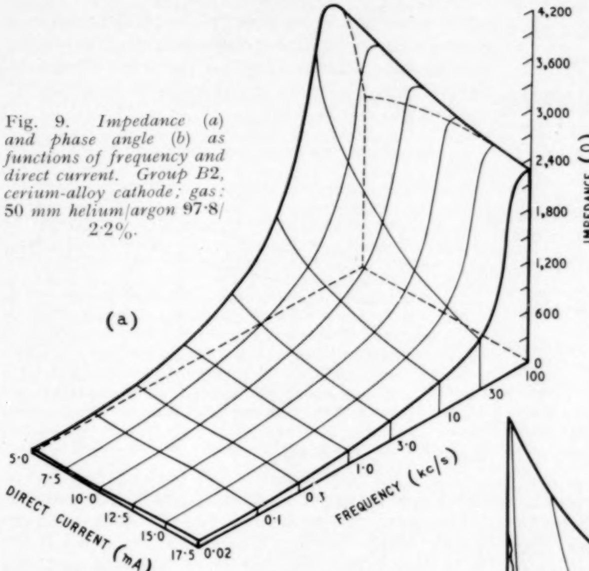
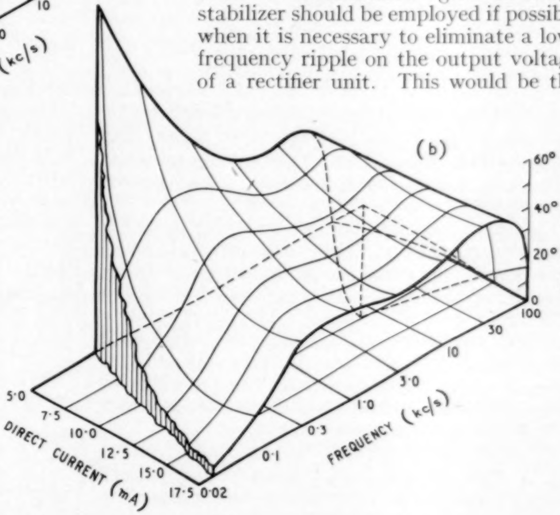


Fig. 9. *Impedance (a) and phase angle (b) as functions of frequency and direct current. Group B2, cerium-alloy cathode; gas: 50 mm helium/argon 97·8/2·2%.*



The results obtained on tubes with cerium-alloy cathodes are shown in Fig. 8 for 99·7/0·3% neon/argon fillings and in Fig. 9 for 97·8/2·2% helium/argon fillings. In general, these diagrams are similar to the respective curves obtained with nickel cathodes. There is, however, one striking difference. For tubes with nickel cathodes, very similar resonant frequencies and identical impedance values at the resonant frequency have been observed for neon and helium gas fillings. For the batch of tubes with cerium-alloy cathodes, however, the resonant frequency is higher and the corresponding impedance is much lower in the case of the helium/argon mixture than in the case of the neon/argon mixture. Two batches of tubes, having slightly different constructions, have been tested and this effect was observed in each case.

(b) Tubes with Different Gas Pressures

The results of impedance–frequency measurements for the neon/argon tubes with different gas pressures, when operated at a constant direct tube current of 10 mA, are summarized in Fig. 10.

It is found that as the gas pressure increases, the impedance drops and the resonant frequency increases. It is difficult to obtain a general expression connecting the impedance Z with gas pressure p. At the lower frequency end of the range, however, $Z \propto 1/p^3$ approximately as illustrated by Fig. 11. For frequencies over 1,000 c/s this relation is not true; then $Z \propto 1/p^n$ where n is greater than 3.

Discussion of Results

It is evident from the above results that a helium-filled glow-discharge stabilizer should be employed if possible when it is necessary to eliminate a low-frequency ripple on the output voltage of a rectifier unit. This would be the case for the 100-c/s ripple voltage present in the output of many rectifier units. When a high-frequency ripple component is present, however, it is better to use a neon-filled stabilizer. The internal impedance of a neon tube in this region is not greater than that of a corresponding helium one and helium tubes have the disadvantage that their internal impedance contains a large inductive component. This often results in distortion of the superimposed alternating voltage waveform. Sudden changes in the glow have been observed and the impedance increases to many times the value measured under ordinary conditions. This distortion in the waveform may be due to superimposed parasitic oscillations.

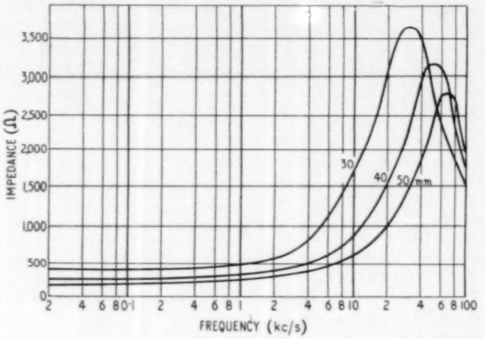


Fig. 10. *Impedance as function of frequency for different gas pressures (d.c. = 10 mA); gas: neon/argon 99·33/0·67%.*

The resistance of the tube being very low, resonance may occur between the large effective inductance L and the effective capacitance C'. Changes in the glow are particularly frequent when the superimposed alternating current is large. Thus a neon-filled stabilizer should also be used when the ripple voltage is so large that changes in the glow occur. The impedance of the neon tube in the low-frequency range may be reduced by increasing the gas pressure.

The authors have not so far been able to give a definite explanation of the differences observed between the impedance characteristics of tubes with nickel and cerium-alloy cathodes and having a helium/argon gas filling. The shift of the resonant frequency in the case of tubes with cerium-alloy cathodes seems to be due to the increase of the argon content in the gas filling to 2·2%. It seems unlikely that the cathode material will affect the impedance markedly.

It might be thought from an inspection of Fig. 7 that to get low impedance the direct current through the tube should be increased as far as possible. It should be remembered, however, that the life of a tube depends very much on the current at which it is operated. Similar considerations apply to the increase of gas pressure. The current density increases approximately in proportion to p^2, therefore large currents are needed to maintain a uniform cathode glow at high pressures.

The authors wish to stress that during the present investigations they have not been trying to produce tubes with very low impedance. They have been concerned only with the differences which are to be expected between tubes containing neon or helium and the influence of gas pressure and steady tube current changes. It is necessary to point this out because it is known that differences in tube construction have a very large effect on the resulting impedance characteristic. For example, Townsend and Depp[1] have stressed the importance in this respect of anode–cathode spacing and cathode area. The special tubes constructed for the work described here closely resemble many modern commercial miniature types.

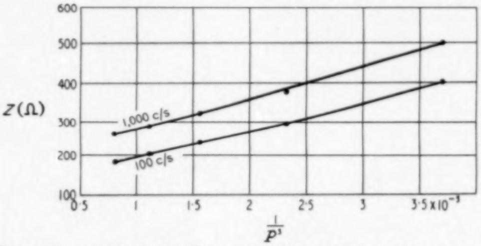


Fig. 11. *Impedance Z as function of gas pressure p; $Z \propto 1/p^3$ (p in mm of mercury).*

Acknowledgments

The work recorded here has been carried out in the Department of Electrical Engineering at the University of Sheffield. The authors wish to thank Mr. O. I. Butler, M.Sc., M.I.E.E., A.M.I.Mech.E., for facilities afforded in the laboratories of this Department. They also wish to acknowledge the kindness of The English Electric Valve Co. Ltd. in supplying all the special tubes for examination and are grateful to them for helpful discussions and valuable suggestions.

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CORRESPONDENCE

Letters to the Editor on technical subjects are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

A.M.-F.M. Demodulator

SIR,—A new method of demodulation has been developed by utilizing the rise-time characteristic of a pulse of constant amplitude obtained by properly limiting an amplitude- or a frequency-modulated wave.

Trapezoidal pulses of equal amplitude are produced when a sinusoidal wave is limited near the zero axis. The slope of the leading and the trailing edges of these pulses is essentially constant and is a linear function of the amplitude and the frequency of the sinusoidal wave. If a carrier is modulated either in amplitude or in frequency with a modulating signal (the time period of the latter being very long compared to that of the carrier) and is limited so as to select a small slicing level near the zero axis, trapezoidal pulses are produced. Here the slope of both edges of a particular pulse is constant, while for the succeeding pulses the slope varies proportionately according to the variation of amplitude of the modulating signal. It may be stated more clearly that the slope varies according to the instantaneous amplitude of the amplitude-modulated wave, or according to the instantaneous frequency of the frequency-modulated wave as shown in Fig. 1 (a) and (b) respectively.

A modulated wave (either a.m. or f.m.) is thus translated into slope-modulated trapezoidal pulses. On differentiating these pulses by means of a low time-constant CR circuit they are converted into variable amplitude pulses on both sides of the axis, the amplitude of the differentiated pulses being proportional to the slope of the trapezoidal pulses. These a.m. pulses are then detected and passed through a pulse-lengthener circuit followed by an l.f. filter to recover the modulating signal.

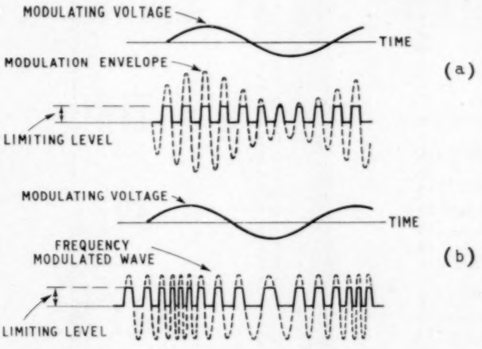

Fig. 1.

The block schematic diagram shown in Fig. 2 illustrates the circuit arrangement used to demodulate a carrier of 100 kc/s modulated by a 400-c/s tone. The modulated wave is first passed through a double-diode clipper followed by a cathode-follower differentiator. The differentiated output is then passed through a detector having an RC load with proper time constant, across which the modulating voltage is obtained and is observed on a c.r. oscilloscope. The system in itself, though less sensitive, is not more complicated than that of a conventional f.m. system. Although the number of operations to be performed on the waveform seem numerous they may be carried out quite simply. Moreover, it eliminates the difficulty of aligning and provides a common system for the reception of both a.m. and f.m. waves.

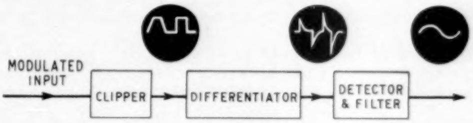

Fig. 2.

The possibility of this system for noise reduction is under investigation. It may, however, be mentioned that the spurious noise in between the translated a.m. pulses may be eliminated by using a properly-biased gating circuit.

P. KUNDU

Indian Institute of Technology,
Khargpur, India.
17th October 1955.

Rectifier-Filter Characteristics

SIR,—I have only recently discovered a paper by Professor E. B. Moullin (*J. Instn elect. Engrs*, 1937, Vol. 80, p. 553) in which he uses an approach to rectifiers which is substantially the same as that presented in my paper on "Rectifier-Filter Characteristics", *Wireless Engineer*, June 1955, p.147. When I presented my paper for publication I was not aware of Professor Moullin's paper and I am surprised that his approach to the problem has never received much attention.

The letter by M. V. Joyce which you published in the September issue of *Wireless Engineer* is very interesting and I think that the criterion advocated by Mr. Joyce is a better one than the one I proposed in my paper. I should, however, prefer to be somewhat more conservative and set the following limits for reasonable prediction of capacitor input filter characteristics:—

$2\pi fCr > 4$ for half-wave rectification,
$2\pi fCr > 2$ for full-wave rectification.

F. G. HEYMANN

University of the Witwatersrand,
Johannesburg, South Africa.
21st October 1955.

PREMIUMS FOR TECHNICAL WRITING

The Radio Industry Council is prepared to award up to six premiums of 25 guineas to the writers of articles published during the year which "are likely to enhance the reputation of the Industry and focus attention of peoples throughout the world on Britain's leadership in the fields of radio, television and electronics".

A leaflet describing the scheme and defining the eligibility of writers is obtainable from the Radio Industry Council, 59 Russell Square, London, W.C.1. This year's entries should be made prior to 31st December to the Secretary at the same address.

BRITISH STANDARDS INSTITUTION

The British Standards Institution has opened a Sales Office in Birmingham at which a stock of British Standards and associated publications will be maintained. It is at the headquarters of the Chamber of Commerce, 95 New Street, Birmingham 2.

NEW BOOKS

Transistors and Other Crystal Valves

By T. R. Scott, D.F.C., B.Sc., M.I.E.E., A.M.Inst.Pet. Pp. 258 + xvi. Macdonald & Evans Ltd., 8 John Street, Bedford Row, London, W.C.1. Price 45s.

The main concern of this book is with the 'internals' of the transistor and the crystal diode. Applications and circuits are not treated at all fully. The book is not intended for the transistor designer, however, but for the user and its purpose is to tell him something of how they work.

Following the introduction, there is a chapter on crystal imperfections, in which it is shown that the imperfections are necessary for conduction in semiconductor materials. Chapter 3 deals with the theory of *p-n* junctions and the design of junction diodes and transistors. Chapter 4 covers point-contact devices and Chapter 5 deals with operating temperature and its effect upon output and life.

There is a chapter covering applications, circuitry and testing and one dealing with special h.f. transistors. Appendixes treat the band structure of semiconductors and testing techniques. There is an extensive bibliography.

The book is, to a large extent, non-mathematical. In spite of this, it is by no means easy reading, but that is to be expected from the nature of the subject. It should form a useful introduction to the subject for the reader having a good general background of physics.

W. T. C.

Repairing Record Changers

By E. Eugene Ecklund. Pp. 278 + ix. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. Price 44s. 6d.

British Standards Institution Annual Report 1954-55

Pp. 243. British Standards Institution, 2 Park Street, London, W.1. Price 5s.

Wireless World Diary 1956

Consequent upon recent changes in purchase tax, the price of the *Wireless World* Diary has been increased to 4s. 2½d. in rexine and 6s. in leather (postage 2d. extra). Including pp. 79 of reference material and pp. 2 per week diary, it is available from Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

Investigation of Deterioration of Moulded Carbon Resistors

By H. F. Church and J. J. Walsh. First Report: Z/T92, pp. 28. Price 7s. 6d. Second Report: Z/T 96, pp. 23. Price 12s. 6d.

The Performance of Insulated Carbon-Resin Film Resistors

By F. G. Rivers. Z/T 95, pp. 13. Price 15s.

The above three reports can be obtained from the Electrical Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

TECHNICAL LITERATURE

Mullard Ferroxcube

Pp. 130. Mullard Ltd., Components Division, Century House, Shaftesbury Avenue, London, W.C.2. Price 7s. 6d.

This book contains technical information on the properties and application of Ferroxcube. The main sections cover magnetic ferrites, types and grades of Ferroxcube, mechanical properties, electrical and magnetic properties, applications, rectangular B-H loop material and standard core shapes and dimensions.

MEETINGS

I.E.E.

7th December. "Some Half-Tone Storage Tubes", by R. S. Webley, B.Sc., H. G. Lubczynski, Dr. Ing. and J. A. Lodge, B.Sc.

12th December. "The Television Studio as seen by the Producer", by Alvin Rakoff.

These meetings will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2 and will commence at 5.30.

Brit.I.R.E.

14th December. "The Remote Presentation of Radar Information", by G. J. Dixon and H. H. Thomas, to be held at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1, at 6.30.

The Television Society

9th December. "The Secondary Emission Valve and its Applications", by A. H. Atherton, to be held at 7 o'clock at the Cinematograph Exhibitors' Association, 164 Shaftesbury Avenue, London, W.C.2.

STANDARD-FREQUENCY TRANSMISSIONS

(Communication from the National Physical Laboratory)

Values for October 1955

Date 1955 October	Frequency deviation from nominal: parts in 10^8	
	MSF 60 kc/s 1429-1530 G.M.T.	Droitwich 200 kc/s 1030 G.M.T.
1	+0·4	+2
2	+0·4	+3
3	+0·4	+2
4	N.M.	+2
5	+0·4	+2
6	+0·5	+3
7	+0·5	+2
8	+0·5	+2
9	+0·5	+3
10	+0·5	+2
11	+0·4	+3
12	+0·5	+3
13	+0·4	+3
14	+0·3	+3
15	+0·4	+3
16	+0·5	+4
17	+0·5	+4
18	+0·5	+4
19	+0·5	+4
20	+0·5	+4
21	+0·4	+4
22	+0·4	+4
23	+0·4	+4
24	+0·5	+4
25	+0·5	+3
26	+0·5	+3
27	+0·6	+5
28	+0·6	+5
29	+0·6	+6
30	+0·6	+6
31	N.T.	+6

The values are based on astronomical data available on 1st November 1955.

N.M. = Not Measured. N.T. = No Transmission.

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(2) Full load current of 200 mA. can now be taken at all output voltages. (Previously limited to 150 mA. above 350 volts.)

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OUTPUT.—High stability D.C. output 200–400 volts adjustable in three ranges. In addition, a fixed unstabilised output of 515–670 volts and two unstabilised 6.3 volt A.C. heater supplies are provided.

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OUTPUT RESISTANCE.—Less than 3 ohms.

RIPPLE.—Approximately 5 mV. R.M.S.

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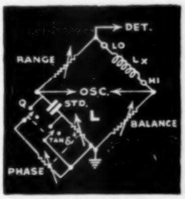
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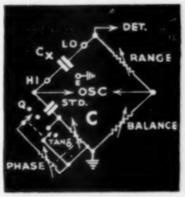
TAN δ
PHASE

ACCURATELY MEASURED

L - AT 1 OR 10 kc/s

C - AT 1 OR 10 kc/s

R - AT D.C.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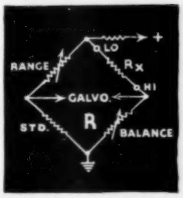
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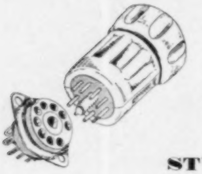

Current Rating....3 amps per contact
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STYLE 1

Plug for use with standard B9A valveholder moulded in woodflour or nylon loaded pf.
With or without cover and cable clamp

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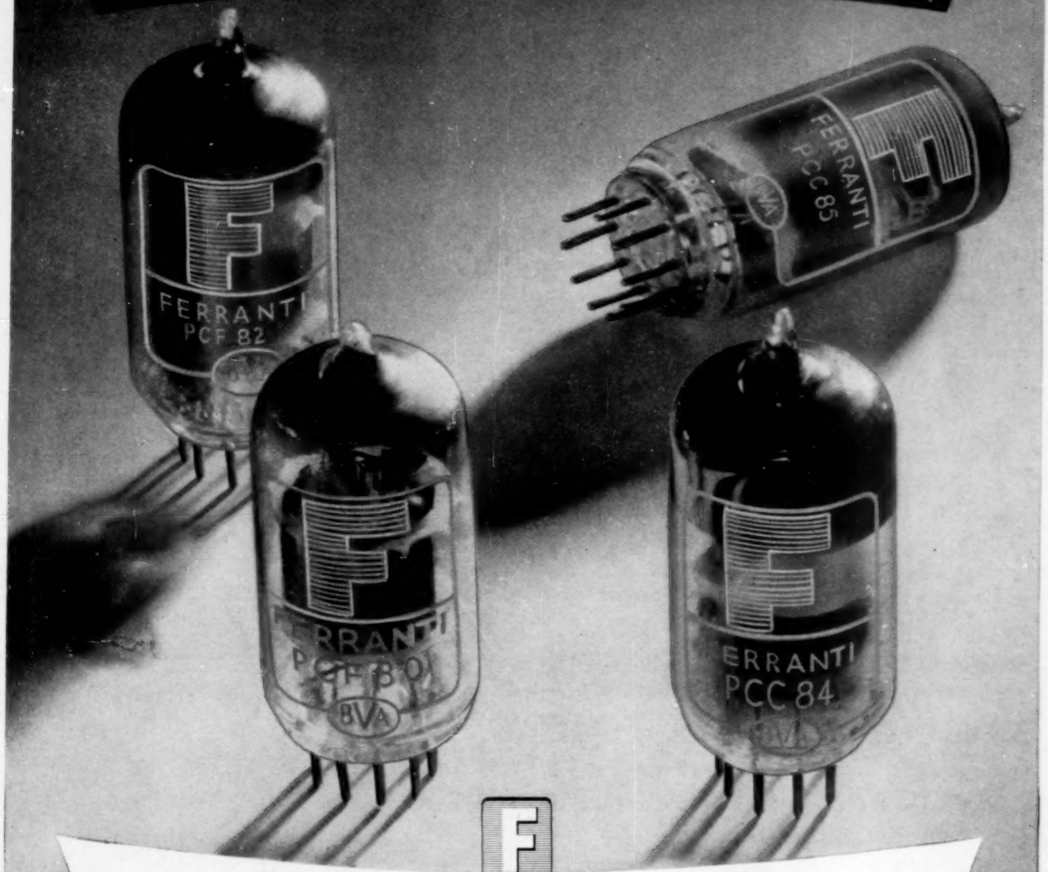

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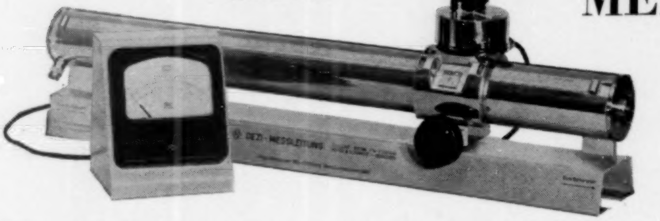

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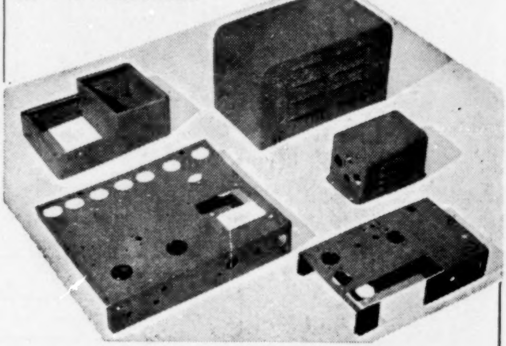

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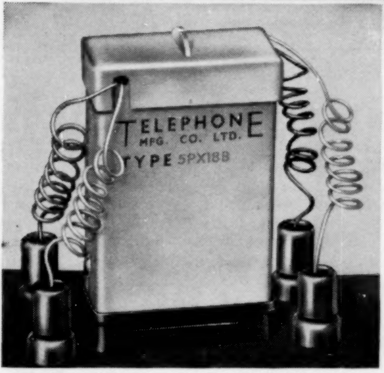

The Type 5PX Carpenter Polarized Relay is fitted with platinum contacts to reduce thermal noise, and has flying contact leads to reduce "pick-up" in contact circuit due to the coil. DIMENSIONS: *Height 2.5 in. Width 1.6 in Depth 0.8 in. Approx. weight 4.8 oz.*

Simplify Recording, Control and Test circuits

The fast operating Carpenter Polarized Relay Type 5PX is being used very satisfactorily in a wide variety of control, recording and test circuits where the available initiating voltage is extremely low and must be greatly amplified before it can be used. The relay enables this to be done efficiently and economically by converting ("chopping") d.c. input signals to a square-wave alternating voltage which may then be amplified simply in an a.c. amplifier.

Alternatively, the small signal voltage can be fed to a straightforward d.c. valve amplifier, while a fraction of the voltage is taken to an a.c. amplifier using an "each-side-stable" Carpenter relay. One side-contact of the relay is used alternately to "earth" and to "free" this input voltage, thereby converting it to square-wave a.c., while the other side-contact demodulates the amplified a.c. output. This output is then fed back to the control grid of the original d.c. amplifier, thereby eliminating any tendency of the output to drift.

The Type 5PX relay has platinum contacts so that contact noise voltages are considerably reduced. Moreover, screening between coil and contact circuits—and flying contact leads, reduce to negligible proportions possible trouble due to "pick-up" from the coil. Where frequencies in excess of 50 c/s are required, specialized versions of the larger Type 3 relay can be used.

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Frequency Response	± 2·5 db from 30 c/s — 20 Mc/s.
Sensitivity	75 millivolts per cm.
Rise-time	30 millimicroseconds.
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Range	0·05 second to 1·5 microseconds.
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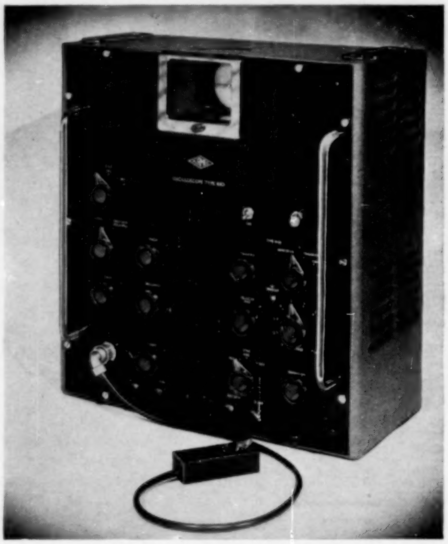

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(b) **Experimental Officer (Unestablished)** for research and development work at Trinity House, London. The duties will include the study and use of large power sound signals. A knowledge of the mathematical treatment of sound waves will be useful.

Qualifications for both above posts: Higher National Certificate or equivalent.

(c) **Assistant Engineer (Unestablished).** This post is for an assistant to the officer-in-charge of the south coast experimental station above, and will involve work along the same lines.

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Applications should be made in writing to the Secretary, Trinity House, Tower Hill, London, E.C.3, not later than 17th December 1955, and should state age, occupation, qualifications, experience and enclose copies of testimonials.

The **Independent Television Authority** invites applications for the post of **Transmitter and Aerial Engineer** in its Headquarters establishment.

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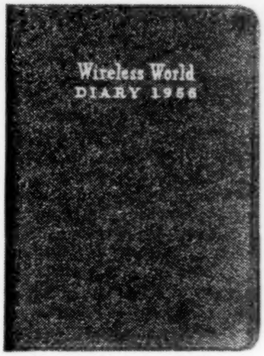

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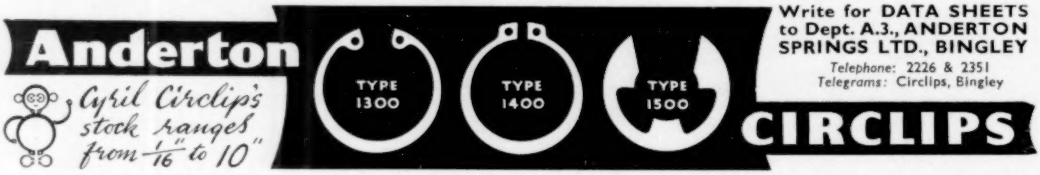

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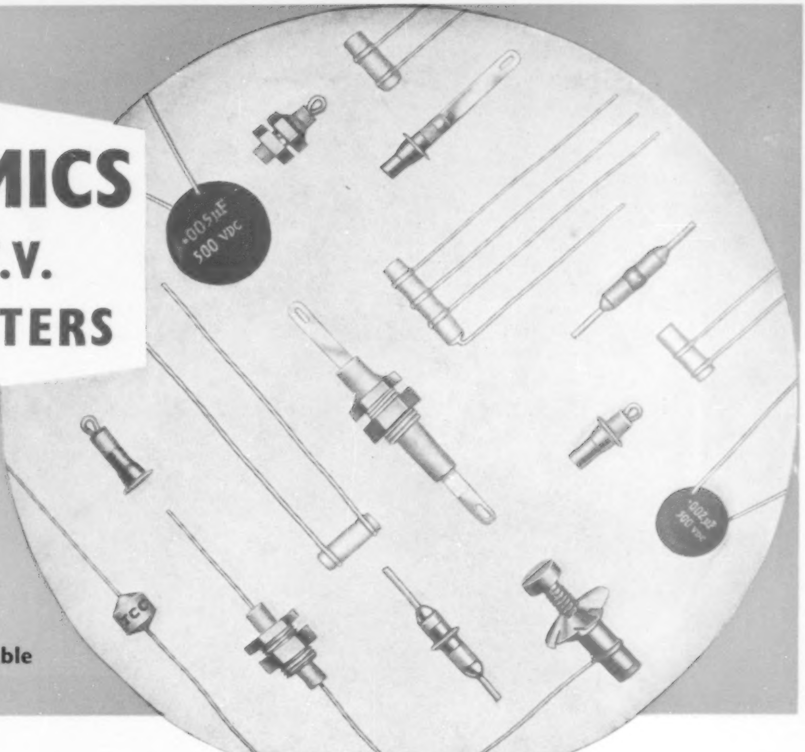

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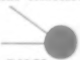

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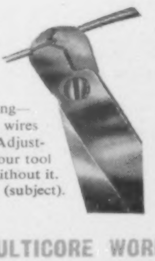

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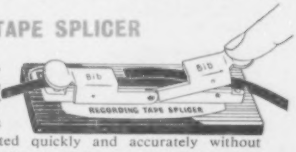

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U.D.C. CHANGES

In anticipation of a new edition of the Universal Decimal Classification Abridged English Edition (BS 1000 A), certain changes in U.D.C. numbers will be made in this and subsequent issues. The new numbers used will be:

Radio astronomy : 523.16
Ultrasonics : 534 subdivisions with the special analytical subdivision -8 attached
Sound recording and reproducing : 534.85
Electroacoustic problems, transduction, etc. : 534.86

ACOUSTICS AND AUDIO FREQUENCIES

534.1 1

Transverse Vibrations of a Symmetric Tapered Reed.—A. Leitner & E. A. Hiedemann. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 509–510.) Frequencies and node positions are calculated for double-tapered bars of a type used for ultrasonic generators, by combining the exact methods of Rayleigh and Kirchhoff for uniform and tapered bars respectively.

534.1-8 : 621.317.755 2

Analyzing Ultrasonic Pulses by the Split-Reflector Method.—R. A. McConnell. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 563–565.) Frequency modulation within the pulses from a pulsed ultrasonic oscillator is analysed by directing the beam on to a plane reflector which is split into a fixed and a moving part, and observing on a c.r.o. the amplitude fluctuations of the middle portion of the reflected pulse as the position of the movable reflector is varied. The method is applicable at frequencies >5 Mc/s and is specially suitable for modulation in the range 0·1–5%.

534.2 3

Transmission of Sound through Thin Elastic Plates.—J. E. Young. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 485–492.) An investigation is made of transmission through the plate when mounted (*a*) in a plane infinite baffle, and (*b*) in a duct of infinite length. The effect of boundary conditions is examined; the concept of bending impedance is introduced as a criterion of the mounting conditions. Experiments made with a circular plate in a 3-in.-diameter tube are reported; the plate holder was designed to provide a choice of boundary conditions. Reasonable agreement was obtained between theoretical and experimental results.

534.231.3 : 621.395.616 4

Acoustic Impedance of a Right Circular Cylindrical Enclosure.—F. Biagi & R. K. Cook. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 506–509.) "At low frequencies, the acoustic impedance of a right circular cylindrical enclosure (containing air, or other gases) is affected by the cooling effects of the walls. Analytical expressions for the temperature distribution have been obtained, and computations of the effect on the impedance are given in the form of plotted correction factors. These corrections are used in making absolute pressure calibrations of condenser microphones at low frequencies."

534.3/.4 5

Tentative Classification of Methods of Processing Musical Signals.—A. Moles. (*Ann. Télécommun.*, July/Aug. 1954, Vol. 9, Nos. 7/8, pp. 201–204.) Discussion is presented in terms of the representation of the musical sound in the three dimensions level, pitch and duration. Elementary entities are distinguished from complex musical signals of indefinite duration. Processing methods include limiting (of frequency, level or duration), inversion, transposition and repetition.

534.373 : 534.414 6

A Study of the Factors influencing the Damping of an Acoustical Cavity Resonator.—R. F. Lambert. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, p. 583.) Correction to paper abstracted in 1643 of 1954.

534.64 7

The Horn as a Coupling Element for Acoustic Impedance Measurements.—T. D. Northwood & H. C. Pettigrew. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 503–506.) A modified impedance-tube method is described for determining the absorption of acoustic materials, suitable for measurements over a wide frequency range with samples of size 12-in.-square or greater. The sample is mounted at the mouth of a horn and the measurement is made at the throat of the horn, using a conventional impedance tube. A comparison of results obtained by this method and by the ordinary impedance-tube method (with small samples) indicates that with certain modifications of the horn the method should be satisfactory at frequencies up to 3 kc/s.

534.7 **8**

The Measurement of Human Channel Transmission Characteristics.—W. A. Munson & J. E. Karlin. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 542–553.) Information-theory concepts are used in an investigation of the human being as a communication channel. Techniques using binary signals are discussed for measurement of the transmitted information. A model proposed to represent the channel involves as parameters the noise level and the discriminator sensitivity of the human circuits. Psychophysical tests illustrating the usefulness of these concepts are described.

534.78 **9**

Some Further Experiments upon the Recognition of Speech, with One and with Two Ears.—E. C. Cherry & W. K. Taylor. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 554–559.) Continuation of investigation noted previously [947 of 1954 (Cherry)].

534.78 **10**

Intelligibility of Different Speech Materials.—I. J. Hirsh, E. G. Reynolds & M. Joseph. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 530–538.) Investigations are reported of the recognizability of nonsense syllables and of words with various numbers of syllables, as a function of the cut-off frequency of low-pass and high-pass filters and of signal/noise ratio at different noise levels. Results indicate that the elimination of all frequencies above or below 1 600 c/s does not seriously affect the intelligibility of words.

534.78 : 519.272.1 **11**

Short-Term Autocorrelation Analysis and Correlatograms of Spoken Digits.—R. Biddulph. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, pp. 539–541.)

AERIALS AND TRANSMISSION LINES

621.372.2 **12**

A Series-Laminated Conductor for High Frequencies.—H. Ataka. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1527–1529.) Skin effect is reduced in an h.f. line by use of alternate lengths of conducting and insulating material; the arrangement is contrasted with that of Clogston (2908 of 1951) where the conducting and insulating materials alternate in the transverse direction. The uniformity of the current distribution over the cross-section improves as the length of the sections decreases; in practice an optimum length exists.

621.372.2 **13**

A Coaxial Line filled with Two Non-concentric Dielectrics.—D. J. Angelakos. (*Trans. Inst. Radio Engrs*, July 1954, Vol. MTT-2, No. 2, pp. 39–44.) Analysis is presented for a coaxial line with different dielectrics occupying separate cross-sectional sectors of the interspace; the system is considered as a bent waveguide of width determined by the guide wavelength and length given by the average circumference. The modal structure of the fields was examined experimentally.

621.372.2 : 621.3.018.75 **14**

Propagation of a Voltage Pulse in a Perfectly Uniform Cable.—M. Cotte. (*Câbles & Transm.*, July 1954, Vol. 8, No. 3, pp. 258–265.) The distortion of a pulse of finite duration propagated along a uniform cable is determined by evaluating a convolution integral involving the response to a unit-pulse input, and the time-function representing the successive instantaneous amplitudes corresponding to the applied input pulse at the distant point. The method is applied to the case of a sine-squared pulse and typical pulse shapes are shown which have been determined by numerical calculation and correspond to propagation of 0.15-, 0·1- and 0·25-μs pulses over different lengths of cable.

621.372.2.029.64 **15**

Step Discontinuities in Disk Transmission Lines.—R. N. Bracewell. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1543–1547.) Analysis developed by Whinnery et al. (736 of 1945) for parallel plane and coaxial lines with step discontinuities is adapted to deal with lines comprising parallel disks with radial propagation. Correction factors involving Bessel functions are derived. Charts are presented for determining the values of the correction factors from simple shape parameters.

621.372.21 : 621.315.213 **16**

Characteristic Impedance of the Shielded-Strip Transmission Line.—S. B. Cohn. (*Trans. Inst. Radio Engrs*, July 1954, Vol. MTT-2, No. 2, pp. 52–57.) Simple design formulae and charts are presented for transmission lines of the type comprising a conducting strip centred between parallel ground plates.

621.372.8 + [535.42 : 538.56 **17**

Electrodynamics Problems of Non-ideally Conducting Bodies having Angularities.—V. A. Il'in. (*C. R. Acad. Sci. U.R.S.S.*, 11th July 1954, Vol. 97, No. 2, pp. 213–216. In Russian.) The two boundary-potential problems considered are the diffraction of e.m. waves by a non-ideally conducting cylinder and the excitation of a non-ideal waveguide. A method is shown of solving the problems provided that the solutions for the case of ideal conductors are known. The effect of the angularities is to introduce an additional term, the 'zone of action' of which depends on the conductivity; for metals the region is negligibly small, for sea-water it is of the order of a wavelength in air. The method may be applied also in the case of a conductivity discontinuity at an angle.

621.372.8 **18**

An Introduction to the Principles of Waveguide Transmission: Part 1—Fundamental Concepts; Generation of Microwave Energy.—C. F. Floyd & W. A. Rawlinson. (*P. O. elect. Engrs' J.*, July 1954, Vol. 47, Part 2, pp. 63–67.) Fundamental principles are presented in nonmathematical terms.

621.372.8 **19**

Circular Waveguide Chart.—A. C. Hudson. (*Electronics*, Oct. 1954, Vol. 27, No. 10, p. 194.) The chart presented facilitates determination of (*a*) the modes that will propagate at a given frequency, (*b*) the cut-off wavelength for these modes, and (*c*) the guide wavelength at this frequency for each mode.

621.372.8 **20**

H_{01} Mode Circular Waveguide Components.—D. A. Lanciani. (*Trans. Inst. Radio Engrs.* July 1954, Vol. MTT-2, No. 2, pp. 45–51.) Three components for mm-λ operation are discussed, (*a*) a transition from rectangular to round waveguide, (*b*) a mode absorber, and (*c*) a 90° bend.

621.372.8 **21**

An Improved Squeeze Section with Constant-Width Region.—H. Severin. (*Z. angew. Phys.*, June 1954, Vol. 6, No. 6, pp. 262–264.) Analysis shows that for a squeeze section of length $l_1 + l_2$ with constant-width middle portion (length l_2), the associated change in electrical length is equal to that obtained with a normal squeeze section of length $l_1 + 2l_2$. This is substantiated experimentally using a 3-cm waveguide with a longitudinal slit in the broad faces measuring 1 m × 1 mm and tapered at the ends; by means of a screw adjustment the guide width is varied by ± 1 mm over a middle region of length 22 cm.

621.372.8 **22**

The Excitation of Plane Surface Waves.—A. L. Cullen. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 225–234; Digest, *ibid.*, Part III, July 1954, Vol. 101, No. 72, pp. 276–277.) The problem is discussed in relation to low-loss microwave transmission systems. Launching efficiency is defined as the fraction of the total power input from the source which is propagated as a surface wave. Launching of an E-type plane surface wave from a slot source above a corrugated or dielectric coated metal plate is considered; high efficiencies are attained for a critical value of source height, the value of which is calculated for two special cases. Possible use of arrangements of this type as end-fire aerials is discussed.

621.372.8 : 537.226 **23**

Analysis of Propagating Modes in Dielectric Sheets.—L. Hatkin. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1565–1568.) Procedure is described for calculating the free-space wavelength and thickness of dielectric to give a required wavelength in the dielectric. The method is based on a combination of geometrical optics and transmission-line analysis.

621.372.8 : [537.562 + 621.318.134 **24**

Topics in Guided Wave Propagation through Gyromagnetic Media: Part 3—Perturbation Theory and Miscellaneous Results.—H. Suhl & L. R. Walker. (*Bell Syst. tech. J.*, Sept. 1954, Vol. 33, No. 5, pp. 1133–1194.) Perturbation theory is used to solve some problems whose treatment is particularly difficult by other methods. These include various cases of cylindrical waveguides enclosing long or short ferrite specimens which partially or completely fill the waveguide section. A numerical study of field patterns of the TE_{11}-limit and TM_{11}-limit mode for various d.c. magnetic fields is given as an addendum to part 1 (2563 of 1954). Part 2: 3129 of 1954.

621.372.8 : 621.372.2 **25**

Circular Polarization in Waveguides and Cavities.—R. W. Klopfenstein. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 291–311.) Design formulae are given for radial transmission lines excited in rotating phase and for an element consisting of a circular waveguide series loaded with a radial line.

621.372.8 : 621.385.029.6 **26**

Problems in the Coupling of the Magnetron to a Waveguide.—M. L. Toppinga & J. Schuytemaker. (*Tijdschr. ned. Radiogenoot.*, July 1954, Vol. 19, No. 4, pp. 157–178.) Equivalent-circuit analysis is used to determine the dimensions of the coupling system. The input admittance of the 'cold' magnetron in a specified reference plane is determined for frequencies in the neighbourhood of the Π mode. The conditions for oscillation and the Rieke diagram are discussed. The theoretical results are compared with measurements on a Type-CV76 magnetron. A detailed indication of the output circuit to be used should be given by the magnetron designer.

621.396.67 **27**

Multipoles and Schelkunoff Waves.—I. Ferrari. (*R. C. Accad. naz. Lincei*, July/Aug. 1954, Vol. 17, Nos. 1/2, pp. 32–37.) Analysis for the harmonic fields of aerials presented by Schelkunoff (*Electromagnetic Waves*, Chapter 10) is discussed. It is shown that the field of a multipole of order n is a linear combination of the fields of the first n terms of Schelkunoff's solution, and is of even or odd order according as n is even or odd.

621.396.676.029.62 **28**

Recessed Metre-Wave Aerials for Aircraft.—S. Zisler. (*Ann. Télécommun.*, July/Aug. 1954, Vol. 9, Nos. 7/8, pp. 205–214.) The dependence of the properties of an aerial on its dimensions and its distance from a reflector are investigated. An account is given of experiments with cylindrical recessed aerials for the frequency range 115–130 Mc/s with a polar diagram suitable for homing. The aerial conductor is of silvered brass, and the reflector, constituted by the recess wall, is of duralumin. Calculations are presented for simple and for wide-band matching and for a double aerial. Radiation patterns are shown.

621.396.677.012.12 **29**

Spatial Power Distribution Diagrams for Aerials with Vertical Radiation.—P. Adorian. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No. 9, pp. 434–435.) Diagrams are presented, in a form suitable for design calculations, for 4-element and 16-element arrays intended primarily for broadcasting in the tropics [2335 of 1952 (Adorian & Dickinson)]. These diagrams are to appear as Figs. 38 and 39 in the C.C.I.R. Antenna Diagrams Handbook.

621.396.677.3 : [621.396.65 + 621.396.96 **30**

The Application of [u.h.f.] **Radio Beams to Radar, Multiplex and Television Techniques.**—R. Aubert. (*Rev. gén. Élect.*, July 1954, Vol. 63, No. 7, pp. 348–363.) Basic principles of radar are reviewed in simple terms to emphasize the significance of the high gain resulting from use of very short wavelengths with directive aerials. Illustrations show various types of radar and radio-link aerial.

AUTOMATIC COMPUTERS

681.142 **31**

Lectures on Electronic Computing.—L. Kosten & W. L. v. d. Poel. (*Tijdschr. ned. Radiogenoot.*, July 1954, Vol. 19, No. 4, pp. 211–212.) English summaries are given of the following papers:—

The History of the Electronic Computing Machine 'PTERA', Purpose and Possibilities.—L. Kosten.
The Functioning of the Electronic Computing Machine 'PTERA'.—W. L. v. d. Poel.
Programming for the Electronic Computing Machine 'PTERA'.—W. L. v. d. Poel.
Discussion of Programme 'A7' for the Electronic Computing Machine 'PTERA'.—L. Kosten.

The complete papers are published in *P.T.T. Bedrijf*, 1953, Vol. 5, pp. 116–148.

681.142 **32**

Elimination of Waiting Time in Automatic Computers with Delay-Type Stores.—A. L. Freedman. (*Proc. Camb. phil. Soc.*, July 1954, Vol. 50, Part 3, pp. 426–438.) A critical survey is made of methods which have been tried for eliminating waiting time, and a description is given of a process developed for determining the amount of waiting time eliminated. The 'optimum programming' method adopted with the ACE pilot model is found to be a combination of several methods. It appears that reduction of waiting time generally has to be paid for in extra complication of programming or design; some exceptions to this rule are indicated.

681.142 **33**

Applications of Electronic Computers to Clerical Work.—T. R. Thompson. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No. 9, pp. 400–411.) An examination is made of different types of clerical work and the circumstances in which an electronic computer can be used with advantage. Experience obtained with LEO, the Lyons equipment, is discussed. See also 3473 of 1954 (Pinkerton et al.).

681.142 **34**

Numerical Methods in Digital Real-Time Simulation.—H. J. Gray, Jr. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, pp. 133–140.)

681.142 : 519.272.1 : 621.376.22 **35**

A Simple Microwave Correlator.—R. H. Wilcox. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1512–1515.) The correlator described uses the ring modulator circuit as a rapid-response multiplier; it accepts signals on coaxial cables and has a wide frequency range.

681.142 : 621.314.7 **36**

The Transistor Regenerative Amplifier as a Computer Element.—G. B. B. Chaplin. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 298–307. Discussion, pp. 308–313. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 572–573.) The transistor is considered as a regenerative amplifier; practical circuits are of two types, those with positive and those with negative output pulse. Applications in the following computer circuits are described: (*a*) single-ended electrical delay-line store; (*b*) shift register; (*c*) circuits performing logical operations.

681.142 : 621.314.7 : 621.318.5 **37**

A Versatile Transistor Circuit.—E. H. Cooke-Yarborough. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 281–287. Discussion, pp. 308–313. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 567–568.) The design is described of point-contact transistor switching circuits such that direct currents of the order of several tens of milliamperes can be handled with a voltage drop of only one or two volts. Applications of these circuits in (*a*) a symmetrical push-pull magnetic writing circuit, and (*b*) a shift register, are considered.

681.142 : 621.317.729 **38**

The "Mechanical Particle", an Analog Computing Machine.—B. Rankin. (*Rev. sci. Instrum.*, July 1954, Vol. 25, No. 7, pp. 675–678.) An arrangement is described in which a mechanism guided by remote control moves over a contour map to simulate the motion of a charged particle in a two-dimensional magnetic field.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.75 : 621.387.4 **39**

A Method ensuring Channel-Width Stability and Equality in a Pulse Amplitude Analyser.—H. Guillon. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 603–608.) Apparatus based on Wilkinson's work (1085 of 1951) has the following characteristics: (*a*) channel width variable between 0·2 and 8 V; (*b*) channel stability within ±0·2% for a 10-hour period of operation; (*c*) possible number of channels, 150 or more according to the type of recorder available.

621.3.018.75 : 621.387.4 **40**

A Flexible Single-Channel Pulse-Amplitude Analyser.—F. J. M. Farley. (*J. sci. Instrum.*, July 1954, Vol. 31, No. 7, pp. 241–245.) The instrument described is designed for measuring the amplitude of voltage pulses of duration 0·2–1 000 μs by pre-setting two voltage limits. It can also be used as a simple discriminator. The complete circuit diagram is given, including details of component values, valve types, etc.

621.314.7 : 621.372.5 **41**

Computation Methods for Transistors and Transistor Circuits treated as Active Quadripoles.—B. Heyman. (*IVA, Stockholm*, 1954, Vol. 25, No. 6, pp. 281–299.) Matrix methods are used. Upper and lower limits for frequency of operation are found using experimentally determined values for the equivalent-network impedances. Stability is discussed.

621.314.7 : 621.375.4 **42**

Raising the Cut-off Frequency of Transistors.—W. Herzog. (*Arch. elekt. Übertragung*, July 1954, Vol. 8, No. 7, pp. 297–300.) The cut-off frequency of transistor operation is raised by neutralizing the collector capacitance by means of inductance connected between collector and emitter. Calculations of the bandwidth between the 3-db points on both sides of the resonant frequency are made for grounded-base, grounded-emitter and grounded-collector arrangements.

621.316.8 : 621.396.822 **43**

L.F. Noise in Resistors.—N. B. Montagnon. (*Wireless Engr*, Oct. & Nov. 1954, Vol. 31, Nos. 10 & 11, pp. 255–263 & 301–305.) Account of an extended investigation of the noise produced by resistors carrying a.c. Exciting voltages were used having magnitudes between 10^7 and 10^8 times the noise voltage over a narrow frequency band; the filtering techniques for separating these two voltages are discussed. Measurements on various types of resistor were made at 5 kc/s with excitation frequencies ranging from 50 kc/s to 5 Mc/s and various excitation levels. The noise varies as an inverse power of frequency up to a few megacycles per second, beyond which it is independent of frequency. The r.m.s. noise in volts per cycle bandwidth depends on a power of the applied voltage which ranges from 2·26 at 50 kc/s to 2·75 at 1 Mc/s. Some composition-type resistors exhibit an increase in noise output after passing a.c. for long periods.

621.317.727 : 621.316.8 **44**

Component Design Trends—Precision Potentiometers use New Materials.—F. Rockett. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 144–151.) Use of resistance elements made from deposited metal films, conductive plastics or lossy liquid dielectrics gives "infinite resolution". Other new design and construction techniques give increased life and reliability.

621.318.4 : 621.396.61 **45**

Dimensioning Solenoids for Transmitter Circuits.—E. Achard. (*Ann. Radioélect.*, July 1954, Vol. 9, No. 37, pp. 281–285.) Simple formulae and a graph, based on Medhurst's expression for Q (1694 of 1947), are assembled, and their use illustrated in four worked examples.

621.319.4 **46**

The Effect of Certain Contaminants on the Capacitance and Losses of Pyralene-Impregnated-Paper Capacitors.—J. Coquillion. (*Rev. gén. Élect.*, July 1954, Vol. 63, No. 7, pp. 401–411.) Undesirable effects can be eliminated by avoiding the use of resin flux in the soldering process.

621.372 **47**

Conversion of a Brune Cycle with an Ideal Transformer into a Cycle without an Ideal Transformer.—F. M. Reza. (*J. Math. Phys.*, July 1954, Vol. 33, No. 2, pp. 194–198.) An alternative proof to that of Bott & Duffin (1108 of 1951) is given for the existence of a network configuration without an ideal transformer corresponding to any positive real function. See also *J. appl. Phys.*, June 1954, Vol. 25, No. 6, pp. 807–808.

621.372 **48**

On Electrical Network Determinants.—N. F. Tsang. (*J. Math. Phys.*, July 1954, Vol. 33, No. 2, pp. 185–193.) Four theorems dealing with the relation between the loop determinant and the node determinant of a network are presented, with examples of their application.

621.372 **49**

Analysis of Transmission-Line Directional Couplers.—W. L. Firestone. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1529–1538.) "Five different types of transmission line systems are analysed and are shown to possess directional properties at the lower radio frequencies. The conditions of mismatch on either transmission line or on both transmission lines have been taken into account, as well as lengths of coupling greater than a fractional wavelength. A new and more general scatter matrix for directional couplers which includes the condition of mismatch is developed. In addition, lumped circuit directional couplers have been developed as a consequence of the general transmission line theory." See also 987 of 1954.

621.372 **50**

The Relations between Circuit Bandwidth and Time Constant.—P. Poincelot. (*Ann. Télécommun.*, June 1954, Vol. 9, No. 6, pp. 191–192.) See 664 of 1954. A correct method for specifying bandwidth involves fixing *a priori* limits for a response curve and considering the relation between amplitude and phase distortion in order to determine the limits applicable under transient conditions.

621.372 : 681.142 **51**

Weighting Functions for Time-Varying Feedback Systems.—J. A. Aseltine & R. R. Favreau. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1559–1564.) Technique is presented for analysing the response of a linear time-varying system to a step-function input, using an analogue computer. The method involves synthesis of the adjoint system.

621.372.015.3 **52**

Measurement and Calculation of Carrier-Frequency Transients.—W. Händler & J. Peters. (*Arch. elekt. Übertragung*, July 1954, Vol. 8, No. 7, pp. 301–304.) A carrier modulated by rectangular pulses is passed through a transmission system, and the output is observed oscillographically, the timebase being synchronized by the pulses. The oscillogram thus displays the envelope of outputs for different carrier phases at initiation of the pulses. It is shown mathematically that this envelope corresponds with the result obtained analytically by the reduction method [1249 of 1953 (Peters)]. See also 2246 of 1953.

621.372.029.6 : 538.221 **53**

Practical Applications of Ferromagnetic Resonance.—K. H. Reich. (*Arch. elekt. Übertragung*, July 1954, Vol. 8, No. 7, pp. 317–323.) Theory is outlined and a survey is made of known applications such as u.h.f. attenuators, modulators, gyrators, etc. Advantages and disadvantages of devices based on this effect are compared with those of devices based on the Faraday effect. Deeper understanding of the physical processes involved is necessary for further practical development.

621.372.029.64 : 538.569.4 **54**

Molecular Microwave Oscillator and New Hyperfine Structure in the Microwave Spectrum of NH_3.—Gordon, Zeiger & Townes. (See 100.)

621.372.412 : 538.565.4.029.6 **55**

Resonance Absorber for Electromagnetic Waves.—E. Meyer, H. Severin & G. Umlauft. (*Z. Phys.*, 22nd July 1954, Vol. 138, Nos. 3/4, pp. 465–477.) An absorber for centimetre wavelengths consists of resonators regularly distributed over a metal plate. The resonators are cavities containing a few milligrammes of Fe powder, and absorb energy by interaction with the magnetic component of the e.m. field. The impedance of the absorber depends on the losses of the individual resonators and on their concentration; a system theoretically giving total absorption at $\lambda = 3{\cdot}2$ cm is obtained by making the impedance 377 Ω, the characteristic impedance of free space.

621.372.5 **56**

New Null Transmission Networks.—E. M. Reid. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 444–446.) Three frequency-selective networks are discussed: (*a*) a balanced *RC* lattice; (*b*) a *RC* variable T; (*c*) a mutual-inductance T. Type (*a*) gives the largest off-null outputs but is not easily adjustable over a range of frequencies. An application of type (*c*) for transformer testing is described.

621.372.5 **57**

The Parallel-T Resistance-Capacitance Network.—L. G. Cowles. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, p. 1547.) Correction to paper abstracted in 661 of 1953.

621.372.5 **58**

The Transfer Function of Networks without Mutual Reactance.—A. Fialkow & I. Gerst. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, pp. 117–131.) Extension of analysis presented previously (3369 of 1952). The theory is applicable generally to two-terminal-pair networks. Synthesis procedure is illustrated by examples.

621.372.5 **59**

An Electrodynamic Perturbation Theorem, with Application to Nonreciprocal Systems.—A. G. Redfield. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1021–1024.) A modification of the reciprocity theorem is used to evaluate the antisymmetric part of the admittance matrix of an electrodynamic system in terms of the e.m. fields produced by the applied voltages. The effect of system perturbations on the admittance matrix is determined. The method is applicable to d.c. and microwave gyrators as well as to reciprocal systems, but gives solutions only to a first order of approximation.

621.372.5 **60**

The Voltage Ratio and Output Impedance of a Ladder Network composed of *n* Similar Elements.—T. S. Fox & K. R. Sturley. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 447–448.) Simple expressions are derived using Thévenin's theorem.

621.372.5 **61**

The Complete Specification of a Network by a Single Parameter.—M. S. Corrington, T. Murakami & R. W. Sonnenfeldt. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 389–444.) "If the transfer function of a linear passive network is defined as the output response divided by the input driving force, it can be written in either polar or Cartesian form, $T(\omega)\,e^{i\theta(\omega)} = P(\omega) + i\,Q(\omega)$, where $T(\omega)$ is the amplitude response, $\theta(\omega)$ is the phase characteristic, $P(\omega)$ is the in-phase component, and $Q(\omega)$ is the quadrature component. The transient response to a unit-step function, $A(t)$, can be determined within a constant from either $P(\omega)$ or $Q(\omega)$ alone. $P(\omega)$, $Q(\omega)$, and $A(t)$ are all related, and any one can be used to compute the other two. The derivation of these relations is valid for networks with either distributed or lumped constants, including transducers, and the question of minimum phase does not arise. A graphic method is described for computing $A(t)$ from either $P(\omega)$ or $Q(\omega)$ and universal curves are included. Equipment is described which sweeps $P(\omega)$, $Q(\omega)$, or a polar plot of $T(\omega)$ and $\theta(\omega)$ directly. An intensity frequency marker circuit is included which produces multiple, harmonically related dots on the sweep response. It is also possible to sweep the departure from phase linearity. By a heterodyne process the sweep can be used on low-pass or band-pass systems."

621.372.5.012 **62**

A New Transducer Diagram.—R. N. Bracewell. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1519–1521.) A diagram is presented in which a loss-free quadripole is completely represented by two straight lines and a point. The method is based on projective geometry and gives a visual as well as a numerical presentation of the impedance transformation effected by the network.

621.372.54 **63**

The Correspondence between Ladder Filters connected between a [finite] **Resistance and Zero or Infinite Impedance, and Ladder Filters connected between Two Resistances.**—J. E. Colin. (*Câbles & Transm.*, July 1954, Vol. 8, No. 3, pp. 205–218.) The response curve of a quadripole, defined in terms of image parameters, and inserted between two finite resistances, is determined by separating the actual insertion loss into components. The analysis is developed for the case of one of the resistances becoming infinite or zero. Alternative analysis is given for the quadripole defined in terms of its component impedances. Relations are derived for transforming a ladder filter connected between two resistances to a network giving the same attenuation/frequency characteristic when the source impedance is infinite or zero.

621.372.54 **64**

Antimetrical Lattice Filters.—J. Oswald. (*Câbles & Transm.*, July 1954, Vol. 8, No. 3, pp. 225–253.) Detailed treatment by image-parameter theory illustrates the complete correspondence between this class of filter and the conventional symmetrical type. Practical examples are given and design formulae for low-pass, high-pass and band-pass networks are tabulated. See also 2597 of 1953.

621.372.55 **65**

Delay-Line Equalizer.—P. F. Gloess & H. Martin. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 584–587.) Experimental equipment designed for low-definition television can be used either in conjunction with test signals or on lines in service. Manual adjustments are made according to the position of the pulse on the oscillograph screen. A total delay of 2 μs is provided in steps of 0·1 μs, and the cut-off frequency is 4 Mc/s.

621.372.6 : 621.375.232 **66**

Some Properties of Linear Networks with Three Pairs of Terminals and their Applications in realizing Negative Impedances and Negative-Feedback Amplifiers.—F. Job. (*Câbles & Transm.*, July 1954, Vol. 8, No. 3, pp. 219–224.) Analysis of six-terminal networks based on a generalization of Thévenin's theorem gives a general method of circuit synthesis in which the prescribed impedances may have a positive or negative real part which is independent of the gain and internal impedance of the active element. A method of amplifier design on this principle is illustrated in which input and output impedances are independent of the terminations at the opposite ends.

621.373 **67**

Theory of 'Pulling-In' by a Small-Amplitude External Force.—R. V. Khokhlov. (*C. R. Acad. Sci. U.R.S.S.*, 21st July 1954, Vol. 97, No. 3, pp. 411–414.) A method is developed for calculating the effect of small periodic external forces on an oscillating system. The method is illustrated by considering the effect of a small sinusoidal voltage of frequency p on a valve oscillator with a natural frequency ω_0, the difference between the frequencies being small.

621.373.42 : 621.376.3 **68**

Nonlinear Study of Frequency-Modulated Oscillator.—J. Gross. (*J. Franklin Inst.*, June 1954, Vol. 257, No. 6, pp. 481–490.) Analysis is presented to show how the nonlinear damping of the valve limits the growth of oscillations in the case of parametric excitation, thus permitting the establishment of a stationary oscillation.

621.373.421 **69**

Generalized Equations for *RC* Phase-Shift Oscillators.—S. Sherr. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, p. 1568.) Correction to paper abstracted in 2890 of 1954.

621.373.43 **70**

The Design of a Simple [pulse] **Modulator of Moderate Cost.**—C. Azéma. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 609–613.) A low-power (7 000 V, 6 A peak) pulse generator for laboratory work designed to deliver 0·8–1-μs or 2·2-μs pulses at varying repetition frequencies when the load impedance may vary between 900 and 1 700 Ω is described. Since the power required is low, a Type-PL21 thyratron, with a delay line in the anode circuit, is used to drive the Type-QQE06/40 double-tetrode modulator stage.

621.373.43 **71**

A Low-Frequency Pulse Generator with Independent Control of Pulse Shape and Pulse Frequency.—W. Seefeldner. (*Z. angew. Phys.*, June 1954, Vol. 6, No. 6, pp. 282–283.) A modified multivibrator circuit is described in which the pulse repetition frequency is controlled by a variable resistance in the control-grid circuit of a heptode and the pulse duration by the voltage on a second control grid, the screen voltage being stabilized. The circuit shown can be used with the 'photoformer' described by Sunstein (*Electronics*, Feb. 1949, Vol. 22, No. 2, pp. 100–103) to generate pulses of any shape with repetition frequency variable between 0·5 and 2 800 pulses/sec and pulse duration 140 ms–350 μs.

621.375.13 : 621.3.016.35 **72**

Multiloop Feedback Amplifiers.—O. P. D. Cutteridge. (*Wireless Engr*, Nov. 1954, Vol. 31, No. 11, pp. 293–294.) A stability criterion is derived which involves only one Nyquist plot.

621.375.132 73

Rational Negative-Feedback and Equalizer Circuits or Servomechanisms with Prescribed Characteristics.—W. Bader. (*Arch. elekt. Übertragung*, July 1954, Vol. 8, No. 7, pp. 285–296. Correction, *ibid.*, Sept. 1954, Vol. 8, No. 9, p. 425.) The basic feedback-amplifier circuit is examined with the object of determining the design of the transformation and feedback networks so as to obtain a given overall frequency response for a given response of the amplifier alone. Servomechanisms and equalizers are treated as particular cases.

621.375.221 74

Wide-Band Amplifiers for Bandwidths up to 200 Mc/s.—L. M. Hellerstedt. (*Chalmers tek. Högsk. Handl.*, 1954, No. 137, 36 pp.) An account is given of theoretical and experimental investigations of amplifiers of the type using low-pass filters as interstage couplings. These are superior to distributed amplifiers up to a certain frequency, the value of which is about 130 Mc/s when Type-6AK5 valves are used and 200 Mc/s with Type-404A valves. A practical limit for the number of reactances in the coupling circuit is about five: further increase would call for too narrow tolerances on the components and would greatly increase alignment difficulties. Theoretical computations of the coupling circuits could not be made accurately because of frequency variations of the components. A high-accuracy frequency-sweep generator is essential for the experimental investigations.

621.375.223 75

The Transfer Function as a Tool in the Analysis of a Resistance-Capacitance Coupled Voltage Amplifier.—D. L. Ming & R. W. Thorpe. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 934–937.)

621.375.23.029.4 76

Fifty-Watt Amplifier for High-Quality Audio.—A. B. Bereskin. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 160–164.) See 2611 of 1954.

621.376.23 77

A Hyperbolic Detector.—D. Ya. Svet. (*C. R. Acad. Sci. U.R.S.S.*, 11th July 1954, Vol. 97, No. 2, pp. 247–249. In Russian.) The detector considered comprises a double triode the grids of which are in parallel, the anodes in push-pull and the cathodes biased separately. The detection characteristic will be hyperbolic if a rectangular or trapezoidal characteristic is obtained on plotting the difference between the anode currents against the grid voltage. The effect of varying the modulation voltage is considered.

621.376.23 78

Demodulation of Amplitude-Limited Oscillations.—D. Ya. Svet. (*C. R. Acad. Sci. U.R.S.S.*, 21st July 1954, Vol. 97, No. 3, pp. 441–443. In Russian.) Simple theoretical considerations show that demodulation can be achieved by using a detector with rectangular V_{out}/V_{in} characteristic. The amplitude-modulated amplitude-limited signal is converted by this detector into rectangular pulses whose width is determined by the rate of variation of the input-signal voltage. The amplitude modulation can then be detected by using a second detector having similar characteristics. See also 77 above.

621.376.3 79

Wide-Band Limiter Circuits for Frequency Modulation.—J. Fagot. (*Ann. Radioélect.*, July 1954, Vol. 9, No. 37, pp. 274–280.) A systematic analysis with special reference to f.m. multiplex requirements. The general characteristics of a limiter are defined, and two types considered in detail, (*a*) a grid limiter, and (*b*) a crystal-diode limiter. Circuit arrangements giving best results for large bandwidths are discussed.

621.375.3 80

Magnetic Amplifier Circuits. [Book Review]—W. A. Geyger. Publishers: McGraw-Hill, London, 277 pp., 42s. 6d. (*Wireless Engr*, Nov. 1954, Vol. 31, No. 11, pp. 307–308.) Recommended to all designers and users of magnetic amplifiers.

GENERAL PHYSICS

53.081.4 81

The Decilog: a Unit for Logarithmic Measurement.—E. I. Green. (*Elect. Engng, N.Y.*, July 1954, Vol. 73, No. 7, pp. 597–599.) Difficulties resulting from an extended use of the term decibel are discussed. Suggested new logarithmic units of ratio are reviewed. It is proposed to supplement the decibel by introducing the 'decilog' ('dg'), whose value is such that the number of decilogs is equal to 10 times the logarithm to the base 10 of the ratio.

534.12 82

Lowest Eigenvalues of Nearly Circular Regions.—H. B. Keller & J. B. Keller. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, pp. 141–150.) Analysis relevant to waveguides and vibrating membranes is presented. The principal eigenvalue of the nearly circular element is found by a method involving the circle of equal area. The usefulness of the method is illustrated by comparing approximate values thus found for a rectangle with the exact values.

535.42 : 538.56] + 621.372.8 83

Electrodynamics Problems of Non-ideally Conducting Bodies having Angularities.—Il'in. (See 17.)

537.311.31 : 539.23 : 538.63 84

Thermomagnetic Properties of Thin Metallic Films.—F. J. Blatt. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 13–15.) Theory presented by Sondheimer (331 of 1951) is extended to cover cases involving temperature gradients.

537.311.33 85

Electrons in Lattice Fields.—H. Fröhlich. (*Advances Phys.*, July 1954, Vol. 3, No. 11, pp. 325–361.) A study of the motion of a free electron in the conduction band of an ionic crystal, taking account of the lattice vibrations.

537.525 86

Ignition of Electric Discharge in Gases by Audio-Frequency Current in Tubes with External and Internal Electrodes.—N. A. Kaptsov & N. A. Popov. (*Zh. eksp. teor. Fiz.*, July 1954, Vol. 27, No. 1(7), pp. 97–102.) An experimental investigation is reported of the dependence of ignition and discharge conditions on the frequency of the applied voltage up to 10 kc/s. Tubes filled with H_2, Ne, or Kr at a pressure $\sim$ 0·5–3 mm Hg with either plane or external annular electrodes were used. Results are presented graphically.

537.533 **87**

Interpretation of Electron Emission from Metals and Nonmetals after Mechanical Working or Irradiation.—H. Nassenstein. (*Naturwissenschaften*, July 1954, Vol. 41, No. 14, p. 329.) Conflicting theories of Haxel et al. (3151 of 1951) and Kramer (e.g. 2301 of 1953) can be reconciled by assuming that the emitted electrons come from high energy levels, so that only small amounts of energy are needed to enable them to escape.

537.533 **88**

Temperature- and Field-Emission of Electrons from Metals.—W. W. Dolan & W. P. Dyke. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 327–332.) Calculations are made of emission current density and energy distribution for surface electric field strengths between 2 × 10^7 and 7 × 10^7 V/cm, temperatures up to 3 000°K, and various values of work function. The evaluation is made by numerical integration of the known expression for the emission based on the free-electron theory of metals and the wave-mechanical barrier transmission coefficient of Sommerfeld & Bethe. Results are presented graphically and are consistent with the Fowler-Nordheim field-emission equation for low temperatures and with the Richardson thermionic-emission formula for low fields. The work is relevant to previously reported investigations of the vacuum arc [1026 of 1954 (Dolan et al.)].

537.533 **89**

Backscattering of Kilovolt Electrons from Solids.—E. J. Sternglass. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 345–358.) The total number and energy distribution of backscattered electrons with incident electrons of energy 0·2–4 keV have been measured for C, Fe, Cu, Mo, Ta and Pt, using retarding-potential technique. The dependence on the energy of the incident electrons is characteristically different for elements of atomic number above and below 30. The ratio of the mean energy of the backscattered electrons to that of the incident electrons is about 0·5 for C and increases only slightly with atomic number. The results are interpreted as indicating that inelastic processes are predominant in the scattering of medium-energy electrons.

537.533.1 **90**

Velocity of Electron Pulses.—L. L. Whyte, D. L. Richards & D. Gabor. (*Nature, Lond.*, 28th Aug. 1954, Vol. 174, No. 4426, pp. 398–399.) The transit time of a brief pulse of electrons of known energy across a measured distance was determined by an arrangement involving two deflection gates opened sequentially, for very brief intervals, by a single surge travelling in a cable; an electron multiplier was used as collector. About 90% of the electrons arrived within ±1% of the mean transit time; the most probable transit time could be ascertained within ±0·25%. The apparatus can be used as a velocity spectrograph and as a chronograph for measuring the time of rise of very steep surges.

537.533.8 **91**

Theory of Secondary Electron Cascade in Metals.—P. A. Wolff. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 56–66.) A study is made of the diffusion, energy loss and multiplication of secondary electrons prior to emission. Energy distributions consistent with experimental results are derived, also values for the yield and the dependence of yield on work function.

537.534 **92**

Effect of Vapours of Halogen Compounds on the Emission of Positive Ions from Platinum.—N. Sasaki & M. Onchi. (*Nature, Lond.*, 10th July 1954, Vol. 174, No. 4419, pp. 84–85.)

537.534.8 **93**

Angular Distribution of Secondary Ions on Bombardment of a Tantalum Plate by Ions of Alkali Metals.—U. A. Arifov & A. Kh. Ayukhanov. (*Zh. eksp. teor. Fiz.*, July 1954, Vol. 27, No. 1(7), pp. 87–93.) An experimental investigation is reported of the dependence of the energy and intensity distribution of secondary Na and Rb ions on the angle of incidence of the primary ions. Results are presented graphically.

537.562 : 538.56 **94**

Low-Frequency Plasma Oscillations.—G. V. Gordeev. (*Zh. eksp. teor. Fiz.*, July 1954, Vol. 27, No. 1(7), pp. 19–23.) Theoretical consideration of plasma comprising both electrons and ions with Maxwellian velocity distributions shows that in the absence of an external field the low-frequency plasma oscillations decay; in the presence of an applied electric field undamped oscillations are possible.

537.562 : 538.56 **95**

Excitation of Plasma Oscillations.—G. V. Gordeev. (*Zh. eksp. teor. Fiz.*, July 1954, Vol. 27, No. 1(7), pp. 24–28.) Excitation of h.f. (electron) and l.f. plasma oscillations by a beam of charged particles is considered theoretically, taking account of the thermal scatter of the particle velocities. Results show that undamped l.f. and h.f. oscillations are possible in plasma with an applied electric field.

537.562 : 538.566 **96**

The Attenuation of Alfvén Waves.—J. W. Dungey. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 323–328.) "When the collision frequency in an ionized gas is smaller than the wave frequency, it is not permissible to treat the gas as a continuous fluid. The equations for Alfvén waves are obtained by working with distribution functions. The results illustrate the behavior of a gas when the collision frequency is low and may have applications in the interstellar gas or in the earth's outer atmosphere."

538.3 **97**

A Short Modern Review of Fundamental Electromagnetic Theory.—P. Hammond. (*Proc. Instn elect. Engrs*, Part I, July 1954, Vol. 101, No. 130, pp. 147–157. Discussion, pp. 157–166.) The method of presenting e.m. concepts taking the inverse square law of force between magnetic poles or electric charges as starting point is recommended, as stressing the symmetry of magnetic and electrical relations. Faraday's laws of e.m. induction are discussed and Maxwell's equations are presented in terms of electric and magnetic flux density.

538.3 **98**

Dimensional Relations in Magnetohydrodynamics.—W. M. Elsasser. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 1–5.) An analysis is made of dimensional relations characteristic of e.m. phenomena in fluids. In the absence of instabilities, conditions favourable for accelerating particles to the higher cosmic-ray energies can exist only when the linear dimensions of the fluid are very large.

538.566 : 535.42 **99**

Diffraction of Electromagnetic Waves by an Aperture in a Large Screen.—L. Lewin. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, p. 1053.) Comment on 2078 of 1954 (Crysdale).

538.569.4 : 621.372.029.64 **100**

Molecular Microwave Oscillator and New Hyperfine Structure in the Microwave Spectrum of NH_3.—J. P. Gordon, H. J. Zeiger & C. H. Townes. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 282–284.) An experimental arrangement which can be used as a high-resolution microwave spectrometer, a microwave amplifier or a stable oscillator consists of a focused beam of NH_3 molecules directed into a high-Q oscillating cavity, within which the molecules give up energy. An emission line is seen when the excitation frequency of the cavity is varied through the molecular transition frequency.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **101**

Radio Observations of Ionized Hydrogen Nebulae and Other Discrete Sources at a Wavelength of 9·4 cm.—F. T. Haddock, C. H. Mayer & R. M. Sloanaker. (*Nature, Lond.*, 24th July 1954, Vol. 174, No. 4421, pp. 176–177.) Report of a second survey, made during 10th–18th March 1954; for first survey see *J. geophys. Res.*, March 1954, Vol. 59, No. 1, pp. 155–158. Preliminary results of both surveys are tabulated.

523.16 **102**

Identification of Extended Radio Source near Gemini η with Residual Nebula of Nova Flare-up of 837 A.D.—I. S. Shklovski. (*C. R. Acad. Sci. U.R.S.S.*, 1st July 1954, Vol. 97, No. 1, pp. 53–55. In Russian.) The source reported by Baldwin & Dewhirst (1753 of 1954) is identified. It is predicted that on the 25th June each year the centres of the sun and this source will be only 50′ apart and hence an 'eclipse' will occur. This source, which subtends an angle about equal to that of the sun, affords the possibility of transillumination-type observations of the solar corona; a similar source in the Crab nebula does not approach so closely to the sun, but is smaller and has a higher radio flux.

523.16 : 531.715 **103**

A New Type of Interferometer for Use in Radio Astronomy.—R. H. Brown & R. Q. Twiss. (*Phil. Mag.*, July 1954, Vol. 45, No. 366, pp. 663–682.) "A new type of interferometer for measuring the diameter of discrete radio sources is described and its mathematical theory is given. The principle of the instrument is based upon the correlation between the rectified outputs of two independent receivers at each end of a baseline, and it is shown that the cross-correlation coefficient between these outputs is proportional to the square of the amplitude of the Fourier transform of the intensity distribution across the source. The analysis shows that it should be possible to operate the new instrument with extremely long baselines and that it should be almost unaffected by ionospheric irregularities."

523.16 : 621.396.822.029.62 **104**

Radio Emission from the Andromeda Nebula.—J. E. Baldwin. (*Nature, Lond.*, 14th Aug. 1954, Vol. 174, No. 4424, pp. 320–321.) Observations have been made at a wavelength of 3·7 m with interferometers of different resolving powers to determine the distribution of radio brightness across the nebula M 31. The results suggest the existence of a hitherto unexpected population of radio sources; a similar population in our own galaxy might also account for a large part of the so-called 'isotropic' component of cosmic radio emission.

523.5 : 621.396.11.029.62 **105**

Dependence of Integrated Duration of Meteor Echoes on Wavelength and Sensitivity.—McKinley. (See 250.)

523.5 : 621.396.9 **106**

The Two-Helix Method of Polarization Measurement of Meteoric Radio Echoes.—M. E. Van Valkenburg. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 359–364.) An arrangement for investigating the polarization of radio echoes from meteors uses two helical receiving aerials wound in opposite senses, in conjunction with a helical transmitting aerial. The received signals are combined and displayed on a c.r.o. Operating wavelength is 13·1 m, and power output is 3 kW. The method is applicable to sporadic meteors. Results are in good agreement with theoretical values and with measurements made on shower meteors by Clegg & Closs (655 of 1952).

523.78 : 55 **107**

The Solar Eclipse of June 30, 1954.—(*Sci. & Cult.*, July 1954, Vol. 20, No. 1, pp. 2–3, 34.) Brief report of observations made at Phalodi, about 70 miles N.W. of Jodhpur, including measurements of changes in the ionosphere, of radio noise in the range 550 kc/s–30 Mc/s and of geomagnetic field variations.

550.371 + 550.386 **108**

Short-Period Fluctuations of the Earth's Electromagnetic Field.—V. A. Troitskaya. (*C. R. Acad. Sci. U.R.S.S.*, 11th July 1953, Vol. 91, No. 2, pp. 241–244. In Russian.) Trains of fluctuations of amplitude up to 12 mV/km and a mean period of oscillations in a train of $\sim$ 51 sec were recorded simultaneously at four stations in central Asia on several hundred occasions in 1951–1952. The largest number of trains was recorded between 18 and 19 h universal time, when the sun is near the zenith of the north magnetic pole. The fluctuations could be due to a focusing of solar corpuscular emission by the earth's magnetic field.

551.510.3 : 535.325 **109**

Index of Refraction above 20 000 Feet.—M. Dubin. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 339–344.) Calculations are made on the basis of refractive-index measurements reported by Essen & Froome (1371 of 1952) in conjunction with relevant meteorological data. To an accuracy within 1 part in 10^5, only the density of the air has any significant effect in relation to refractive-index variations at 5 kMc/s, and only at altitudes up to 26 km; variations due to water-vapour content and electrons in the ionosphere are negligible. Thus for practical purposes a standard refractive index can be based on a standard density distribution.

551.510.41 **110**

Origin of Nitrous Oxide in the Atmosphere.—P. Harteck & S. Dondes. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, p. 320.) An explanation of the presence of nitrous oxide based on a photochemical equilibrium is advanced.

551.510.53 **111**

The Upper Atmosphere.—(*Nature, Lond.*, 21st Aug. 1954, Vol. 174, No. 4425, pp. 334–337.) Brief report of a symposium held at Edinburgh in July 1954, at which a survey of the existing state of knowledge about the ionosphere was given by Appleton. Meteor-trail-echo and radio-star-scintillation studies were also discussed.

551.510.534 **112**

Ozone Layer and Air Movements in the Stratosphere.—H. K. Paetzold. (*Naturwissenschaften*, July 1954, Vol. 41, No. 14, pp. 318–322.)

551.510.534 : 523.38 **113**

On New Investigations of the Ozone Layer and its Variations.—H. K. Paetzold. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 365–368.) Various methods of investigation are discussed, including use of lunar eclipses.

551.510.535 **114**

Recombination in the Lower Ionosphere.—A. P. Mitra & R. E. Jones. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 391–406.) Observations of phase height, polarization and absorption at 150 kc/s are analysed to estimate the distribution of recombination coefficient over the altitude range 60–110 km. Theories of recombination are examined on the basis of this distribution. Recombination during the day and during sudden ionospheric disturbances is considered, night-time recombination is not dealt with. The experimental results are consistent with negative-ion theory for altitudes up to about 80 km; above 90 km the predominant process must be dissociative recombination with an effective coefficient of about 3×10^{-8} cm^3/s. There is no evidence of an increase of recombination coefficient during disturbances. See also 2672 of 1954.

551.510.535 **115**

Measurements in the E Layer with the Navy Viking Rocket.—J. E. Jackson. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 377–390.) Results of measurements made by Seddon in November 1950 (403 of 1954) are examined. A rapid increase in electron density from altitude 92 km to near 110 km is indicated, followed by a very slow increase from $1{\cdot}3 \times 10^5$ electrons/cm^3 at 110 km to $1{\cdot}8 \times 10^5$ electrons/cm^3 at 165 km. Seddon's method of measurement is capable of giving accurate results provided suitable operating frequencies are chosen.

551.510.535 **116**

On the Interpretation of the Apparent Ionization Distribution in the Ionosphere.—W. R. Piggott. (*J. atmos. terr. Phys.*, Sept. 1954, Vol. 5, No. 4, pp. 201–210.) "Methods of deducing the highest and lowest ionization distributions which are consistent with a given *h'f* pattern are indicated and the sources of error when using rapid methods of analysis are briefly discussed. Some examples are given."

551.510.535 **117**

Electron Distribution in the Ionosphere.—G. A. M. King. (*J. atmos. terr. Phys.*, Sept. 1954, Vol. 5, No. 4, pp. 245–246.) A note of methods of analysing *h'f* curves to determine electron density distribution and a procedure for taking account of the geomagnetic field simpler than that described by Kelso (2088 of 1954).

551.510.535 **118**

Charge Densities in the Ionosphere from Radio Doppler Data.—W. W. Berning. (*J. Met.*, June 1951, Vol. 8, No. 3, pp. 175–181.) "A method is described whereby the directly observable radial velocities of a missile relative to a ground receiver—both in a radio-Doppler electronic system of tracking—may be compared to radial velocities determined by vacuum-trajectory formulae and the differences converted to ionization densities at the levels through which the rocket is passing. . . . This method was used to compute ion densities for several missiles fired at the White Sands Proving Ground, New Mexico. Results gave density maximums of $0{\cdot}747 \times 10^{11}$ for the D layer at 38 miles, $1{\cdot}69 \times 10^{11}$ for the E layer at 56 miles, and $11{\cdot}4 \times 10^{11}$ for the F_2 layer at 201 miles (all densities in ions per cubic meter)."

551.510.535 **119**

Ionospheric Wind Systems and Electron Concentrations of the F Layer.—D. G. Yerg. (*J. Met.*, Aug. 1951, Vol. 8, No. 4, pp. 244–250.) Theory based on viscous stresses in the ionosphere leads to a simple meridional circulation which explains observed longitudinal differences in the F_2-layer electron concentration.

551.510.535 : 523.745 **120**

The Solar Control of the E and F_1 Layers at High Latitudes.—B. Chatterjee. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, p. 435.) Comment on 406 of 1953 (Scott) and 3211 of 1954 (Saha).

551.510.535 : 621.396.11 **121**

Experiments on Interaction of Radio Waves in the Ionosphere.—Boella. (See 245.)

551.594.221 **122**

A Comparison of the Rates of Change of Current in the Step and Return Processes of Lightning Flashes.—D. B. Hodges. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 582–584.)

551.594.5 **123**

A Statistical Analysis of Low-Latitude Aurorae.—A. B. Meinel, B. J. Negaard & J. W. Chamberlain. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 407–413.)

551.594.5 : 550.384 **124**

Time Sequences and Spatial Relations in Auroral Activity during Magnetic Bays at College, Alaska.—J. P. Heppner. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 329–338.)

551.594.5 : 621.396.96 **125**

Radio Reflections from Aurorae.—K. Bullough & T. R. Kaiser. (*J. atmos. terr. Phys.*, Sept. 1954, Vol. 5, No. 4, pp. 189–200.) Analysis of auroral echoes observed at Jodrell Bank in May and October 1953 indicates: (*a*) echoes are due to direct, nonspecular reflection from an auroral arc extending more than 1 000 km along a parallel of geomagnetic latitude; (*b*) reflection occurs in a region of limited vertical extent at a height of about 125 km; (*c*) observed movements of intense reflecting centres represent the motion of an ionizing agent rather than a mass movement of ionized gas.

551.594.51 **126**

Theory of the Aurora Based on Magnetic Self-Focusing of Solar Ion Streams.—W. H. Bennett & E. O. Hulburt. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 315–319.)

551.594 **127**

Thunderstorm Electricity. [Book Notice]—H. R. Byers (Ed.). Publishers: University of Chicago Press, Chicago; Cambridge University Press, London; 1953, 344 pp. A collection of papers dealing with various aspects of the subject, most of them revised versions of papers presented at the conference held in Chicago in April 1950.

LOCATION AND AIDS TO NAVIGATION

621.396.65 + 621.396.96] : 621.396.677.3 **128**

The Application of [u.h.f.] **Radio Beams to Radar, Multiplex and Television Techniques.**—Aubert. (See 30.)

621.396.93 **129**

Derivation of a Practical Approximation Formula for the "Inherent" Error in a 6-Mast Adcock Array.—G. Ziehm. (*Telefunken Ztg*, July 1954, Vol. 27, No. 104, pp. 97–103.) The "inherent" error is the error due to the finite number of aerials in the array. For angles of incidence $0 < \alpha_E < 30°$, the maximum error occurs at $\alpha_E = 15°$ and is given approximately by $60°.\frac{J_5(K)}{J_1(K)}$ when $\frac{J_5(K)}{J_1(K)} \leqslant 0{\cdot}2$, where $K = \frac{b\pi}{\lambda}$ and b = distance between opposite masts. A graph shows the maximum error for b = 12 m and b = 8 m, at frequencies between 10 and 25 Mc/s. With a 12-m base, but not with an 8-m base, calculation shows that sense determination becomes impossible at a frequency of about 19 Mc/s; this was verified experimentally.

621.396.933.23 **130**

A New French Blind-Landing System.—Guillaume. (*Électronique, Paris,* July/Aug. 1954, Nos. 92/93, pp. 14–18.) A description of Type-A.S.V.23 equipment. A single airfield transmitter is provided with six channels spaced 2·5 Mc/s apart in the range 1·1735–1·186 kMc/s. Four of these are used to transmit pulses at frequencies of 20 and 24 kc/s for course indication, and 30 and 34 kc/s for height indication; 2-μs transponder pulses for distance measurement occupy a fifth channel. The transmitter is connected in turn to appropriate aerials by means of a commutator. The glide path is defined by the axes along which pulse amplitudes are equal. Aircraft equipment comprises a six-channel receiver with a crossed-needle course-height indicator, an interrogator with c.r.o. for distance measurement, and a single common aerial.

621.396.96 **131**

A Method of making a Radar Self-Calibrating.—E. A. Wolff. (*Proc. Inst. Radio Engrs,* Oct. 1954, Vol. 42, No. 10, pp. 1521–1526.) A fraction of the transmitter pulse power is diverted into a microwave transmission line short-circuited at both ends. Each time the pulse is reflected back to the input end, a fraction of the power is tapped off and fed to the receiver; the attenuation/delay curve of the successive reflected pulses gives the calibration. Constructional details and experimental results are given.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **132**

A Differential Leak Detector for Evacuated Vessels.—D. A. Lundberg. (*Electronic Engng,* Oct. 1954, Vol. 26, No. 320, pp. 436–440.) The apparatus described uses two cold-cathode ionization gauges in a bridge circuit, the balance being disturbed when a jet of calor gas is passed over the leak. Operating instructions are given.

535.215 : 546.23 **133**

Rectifying Action and Photoelectromotive Force of Selenium Photocells and the Non-additivity of their Photoconductivity.—Z. A. Gol'dman. (*C. R. Acad. Sci. U.R.S.S.,* 21st July 1954, Vol. 97, No. 3, pp. 415–416. In Russian.) The non-additive effect of illumination by light of wavelengths $\lambda < 650 \times 10^{-9}$ m and $\lambda > 670 \times 10^{-9}$ m was observed by determining experimentally the voltage/current characteristics of the rectifier in darkness and under illumination. The results are presented graphically.

535.37 **134**

Luminescence Today.—J. Ewles. (*Sci. Progr.,* July 1954, Vol. 42, No. 167, pp. 449–455.) A short general survey of progress since 1938. The emergence is discerned of general empirical principles for prescribing the composition and crystal structure of a phosphor to have good efficiency and a desired spectral emission. The effect of addition of a second activator is discussed. Infrared luminescence may be an important future development. Electroluminescence is briefly mentioned.

535.371 **135**

Effect of Internal Field of Phosphor Lattice on Electron Levels of Activators.—K. V. Shalimova. (*C. R. Acad. Sci. U.R.S.S.,* 21st July 1954, Vol. 97, No. 3, pp. 437–440. In Russian.) Tables are presented and discussed of the wavelengths of absorption maxima of activators both in the free state and in the phosphor lattice, and of the corresponding electron states. Activators in the form of ions and atoms in ionic, atomic and layer-type lattices are included.

537.222.2 **136**

Behaviour of the Electron Constituent of an Insulator in an Electric Field.—H. Volz. (*Z. Phys.,* 22nd July 1954, Vol. 138, Nos. 3/4, pp. 330–335.)

537.226.33 : 546.431.824-31 **137**

Dielectric Hysteresis in $BaTiO_3$ Single Crystals.—N. S. Novosil'tsev & A. L. Khodakov. (*Zh. eksp. teor. Fiz.,* July 1954, Vol. 27, No. 1(7), pp. 94–96.) An experimental investigation is reported. Results, which are presented graphically, show the dependence of the dielectric constant of one of the specimens on the temperature between 20° and 150°C, (*a*) at 50 c/s and in a field of strength 9·1 kV/cm, (*b*) at 50 c/s, 22 kV/cm and (*c*) at 10^6 c/s, 0·5 kV/cm. The dielectric-constant/field-strength characteristic of another specimen is shown for field strengths up to 6 kV/cm. Oscillograms of dielectric hysteresis at 50 c/s and 9 kV/cm are shown for the one specimen and at 50 c/s 22 kV/cm for the other.

537.311.3 : 535.215 **138**

A.C. Hall and Magnetostrictive Effects in Photoconducting Alkali Halides.—J. R. Macdonald & J. E. Robinson. (*Phys. Rev.,* 1st July 1954, Vol. 95, No. 1, pp. 44–50.) Results are reported of measurements at room temperature on KBr single crystals with a low concentration of F centres, using a strong steady illumination in the F absorption band and an a.c. technique eliminating space-charge polarization effects.

537.311.33 **139**

Lifetime Measurements for Minority Carriers in Semiconductors.—P. Aigrain. (*Ann. Radioélect.,* July 1954, Vol. 9, No. 37, pp. 219–226.) A critical survey of known methods, from the manufacturers' point of view; a method based on the photomagnetoelectric effect is preferred.

537.311.33 : 535.215 **140**

Surface States of Cadmium Sulfide.—S. H. Liebson. (*J. electrochem. Soc.,* July 1954, Vol. 101, No. 7, pp. 359–362.) "Photoconductive and phosphorescent properties of cadmium sulfide are modified by adsorbed molecules. Change in spectral response of photoconductivity and the phosphorescence efficiency when crystals are exposed to vapors suggest that surface states due to adsorbed molecules aid in recombination. Photovoltaic behavior of rectifying contacts lends credence to the hypothesis that infrared releases otherwise immobile holes."

537.311.33 : 535.215 **141**

Photoelectric Saturation Currents in Semiconductors.—F. Stöckmann. (*Z. Phys.,* 22nd July 1954, Vol. 138, Nos. 3/4, pp. 404–410.) Two mechanisms of conduction are described. In Ge the current is carried by both electrons and holes, hence saturation currents are possible without producing noticeable space charges. In CdS saturation results from current limitation by space charges.

537.311.33 : 537.323 **142**

The Effects of Heat Flow on Thermoelectric Power in Semiconductors.—J. E. Parrott. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 587–588.) A discussion based on a more physical approach than that of Frederikse (1093 of 1954).

537.311.33 : 538.63 **143**

Change of Resistance of InSb due to Transverse Magnetic Field.—H. Weiss & H. Welker. (*Z. Phys.*, 22nd July 1954, Vol. 138, Nos. 3/4, pp. 322–329.) The dependence of the resistance change on the type of conduction, the mobility of charge carriers and the geometry of the specimen is calculated and compared with experimental results. The geometry is of importance for mobilities greater than 10 000 cm/s per V/cm. The resistance of a Corbino disk increased 24·6-fold on applying a transverse field of 10 000 gauss. Results are presented graphically and are also tabulated.

537.311.33 : 546.28 **144**

Conductivity of Silicon.—W. Heywang, M. Zerbst & F. Bischoff. (*Naturwissenschaften*, July 1954, Vol. 41, No. 13, pp. 301–302.) Measurements were made on high-purity *n*-type specimens with high resistivity and high carrier mobility, over a wide temperature range. Anomalies observed in the temperature characteristic of a polycrystalline specimen indicate the presence of barrier layers at grain boundaries. An electron-mobility value of 1 200 ± 100 cm/s per V/cm was determined from measurements on *n*-type single crystals of lower resistivity. Measurements on *p*-type specimens yielded the same linear temperature characteristic for the intrinsic conductivity. The value of 1·12 eV was found for the energy gap

537.311.33 : 546.28 **145**

Use of Silicon *p-n* Junctions for Converting Solar Energy to Electrical Energy.—R. L. Cummerow. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 561–562.) On adapting formulae obtained previously for the efficiency of Si *p-n* junctions in converting monochromatic radiation (155 below), the efficiency of conversion over the whole solar spectrum is found to be less by a factor of two. The value of 17% obtained may be reconcilable with Chapin's results (unpublished) when surface reflection losses and differences in the Si specimens are taken into account.

537.311.33 : 546.281.26 **146**

The Electrical Conductivity of Silicon Carbide.—M. O. Williams. (*A.T.E. J.*, July 1954, Vol. 10, No. 3, pp. 144–158.) The unique molecular structure of SiC is discussed. The apparent deviation of the resistance from Ohm's law is ascribed to effects due to Mott or Schottky potential barriers at the contact surface. Dynamic characteristics are shown for small atmite disks with applied a.c. and pulsed waveforms. An equivalent circuit based on these oscillograms seems consistent with the existence of both types of barrier in the material.

537.311.33 : 546.289 **147**

Theory of the Galvanomagnetic Effects in Germanium.—B. Abeles & S. Meiboom. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 31–37.) An attempt is made to explain observed magnetoresistance effects on the basis of a simple anisotropic model in which the energy surfaces in momentum space exhibit a number of extrema. Equations are derived for the galvanomagnetic coefficients in any crystallographic direction, and an expression is given for the ratio between the mobilities found from Hall-effect and from conductivity considerations. The calculated values of magnetoresistance are in good agreement with those observed by Pearson & Suhl (166 of 1952) for *n*-type but not for *p*-type Ge. See also 2425 of 1954 (Meiboom & Abeles).

537.311.33 : 546.289 **148**

Vacancies and Interstitials in Heat Treated Germanium.—S. Mayburg. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 38–43.) The thermal production of acceptors was studied by annealing experiments. A critical point is found at 516°C; annealing curves for temperatures above this point suggest a bimolecular recombination process, implying that the heat treatment produces comparable numbers of vacancies and interstitials; curves for temperatures below this point suggest that most interstitials are trapped near dislocations before they can recombine with vacancies.

537.311.33 : 546.289 **149**

Oxygen and the Surface Energy-Level Structure on Germanium.—E. N. Clarke. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 284–285.) A brief account of experiments providing further evidence that oxygen produces surface acceptor levels (168 of 1954).

537.311.33 : 546.289 **150**

Spin-Orbit Interaction and the Effective Masses of Holes in Germanium.—G. Dresselhaus, A. F. Kip & C. Kittel. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 568–569.)

537.311.33 : 546.289 **151**

Anisotropy of Cyclotron Resonance of Holes in Germanium.—R. N. Dexter, H. J. Zeiger & B. Lax. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 557–558.) Measurements were made on *p*- and *n*-type Ge specimens at the temperature of liquid He and frequencies of 8·9 and 23 kMc/s, using infrared excitation of carriers. Resonances corresponding to two different hole masses were observed, the two resonances depend to different degrees on the direction of the applied magnetic field. An interpretation in terms of the valence band structure is outlined.

537.311.33 : 546.289 **152**

Infrared Absorption Spectrum of Germanium.—L. H. Hall, J. Bardeen & F. J. Blatt. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 559–560.) Calculations of the absorption by valence electrons in Ge for direct and indirect transitions to the conduction band are based on a band structure partly deduced from cyclotron-resonance experiments (see e.g. 151 above). The results are in qualitative agreement with observations by Brattain & Briggs on thin films of Ge (*Phys. Rev.*, 1949, Vol. 75, pp. 1705–1710).

537.311.33 : 546.289 **153**

The Influence of Cathodic Sputtering in High Vacuum on the Rectifier Effect in Germanium.—H. Baldus. (*Z. angew. Phys.*, June 1954, Vol. 6, No. 6, pp. 241–246.) Single-crystal and polycrystalline specimens of *n*-type Ge with specific resistance between 1·3 and 9·9 Ω.cm were subjected to a cathodic sputtering process carried out at a pressure of $< 5 \times 10^{-6}$ Torr with applied field above 2×10^{5} V/cm, the crystal acting as cathode. The process removed a surface layer of thickness 10^{-5} cm and completely destroyed the rectifying properties of the crystal. These were restored by chemical or electrolytic etching, by annealing at 150°C in an oxygen atmosphere, or by prolonged exposure to air. Voltage/current characteristics of the crystals before and after the different treatments are shown and results are discussed.

537.311.33 : 546.289 **154**

Power Efficiency for the Photovoltaic Effect in a Germanium Grown Junction.—R. P. Ruth & J. W. Moyer. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 562–564.) An experimental investigation is reported of the variation with incident intensity of the efficiency with which the junction converts incident radiation into electrical power. A disk-shaped specimen of thickness <1 mm was used, with the junction parallel to the faces and about 0·1 mm from the *n* face; the resistivity of the *n* material was $>20\,\Omega$. cm, that of the *p* material <1 Ω.cm. Observations were made with continuous-spectrum and with monochromatic illumination. Results are shown graphically.

537.311.33 : 546.289 : 535.215.3 **155**

Photovoltaic Effect in *p-n* Junctions.—R. L. Cummerow. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 16–21.) "The relations between the incoming radiant energy and the outgoing electrical energy are developed in terms of the experimentally measurable constants of the semiconducting material. These results are applied to germanium by making use of constants found in the literature. The high efficiencies calculated for power conversion are strong indication that the *p-n* junction may be a practical device for the direct utilization of solar energy."

537.311.33 : 546.289 : 544.65 **156**

Fluorometric Detection and Estimation of Germanium.—N. A. Raju & G. G. Rao. (*Nature, Lond.*, 28th Aug. 1954, Vol. 174, No. 4426, p. 400.) Traces of Ge have been found to give an intense greenish-yellow fluorescence with a solution of resacetophenone in concentrated sulphuric acid or syrupy phosphoric acid under filtered ultraviolet light. Test procedure is outlined.

537.311.33 : 546.3-1-289-28 **157**

Some Properties of Germanium-Silicon Alloys—E. R. Johnson & S. M. Christian. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 560–561.) Data on composition, density, lattice constant and width of energy gap are tabulated for a series of Ge-Si alloys prepared by a process of homogenization at high temperature.

537.311.33 + 535.37] : 546.47-31 **158**

Effect of Hydrogen on the Conductivity and Luminescence of Zinc Oxide Crystals.—E. Mollwo. (*Z. Phys.*, 22nd July 1954, Vol. 138, Nos. 3/4, pp. 478–488.) Results of an experimental investigation, which is described, show that the electrical conductivity of ZnO crystals increases on heating the specimen in hydrogen and that the green luminescence decreases when the hydrogen pressure is increased at room temperature. Both effects are reversible. The results are presented graphically.

537.311.33 : 546.47-31 **159**

Effect of Adsorbed Oxygen on the Electrical Conductivity of Zinc Oxide Crystals.—G. Heiland. (*Z. Phys.*, 22nd July 1954, Vol. 138, Nos. 3/4, pp. 459–464.) Report of measurements on synthetic single crystals of ZnO in the temperature range from −183° to +300°C. The decrease in conductivity with increased adsorption may be due to the higher donor concentration in the thin surface layer compared with the concentration inside the crystal.

537.311.33 : 546.47-31 : 535.3 **160**

Dispersion, Absorption and Thermoluminescence of Zinc Oxide Crystals.—E. Mollwo. (*Z. angew. Phys.*, June 1954, Vol. 6, No. 6, pp. 257–260.) A report of measurements made of the optical properties of synthetic single crystals of ZnO.

537.311.33 : 546.623.86 **161**

Electrical Properties of Semiconducting AlSb.—R. K. Willardson, A. C. Beer & A. E. Middleton. (*J. electrochem. Soc.*, July 1954, Vol. 101, No. 7, pp. 354–358.) Results are reported of experimental investigations of the resistivity, thermoelectric power and Hall voltage over the temperature range 80°–1 200°K. The energy band separation is 1·5–1·6 eV; electron and hole mobilities are approximately equal and are over 100 cm/s per V/cm. Rectification characteristics are presented for both *p*-type and *n*-type specimens. The semiconducting characteristics are similar to those of Si, the melting point is 370°C lower and the material is considerably cheaper.

537.311.33 : 546.681.86 **162**

Some Properties of *p*-Type Gallium Antimonide between 15°K and 925°K.—H. N. Leifer & W. C. Dunlap, Jr. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 51–56.) The energy-level scheme, mobilities and charge-carrier masses are determined from measurements of Hall effect and resistivity. The ratio of electron to hole mobility is about 5, and the intrinsic energy gap is 0·8 eV. Two acceptor levels must be assumed in order to fit the Hall-effect data.

537.311.33 : [546.817.221 + 546.817.231 + 546.817.241 **163**

The Molar Heats of Lead Sulphide, Selenide and Telluride in the Temperature Range 20°K to 260°K.—D. H. Parkinson & J. E. Quarrington. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415A, pp. 569–579.)

537.311.33 : 549.212 **164**

Electrical Conductivities of Natural Graphite Crystals.— W. Primak & L. H. Fuchs. (*Phys. Rev.*, 1st July 1954, Vol. 95, No. 1, pp. 22–30.) Measurements of potential distributions on the surfaces of crystals carrying current indicate that the ratio between σ_a, the conductivity in the basal plane, and σ_c, perpendicular to the basal plane, is of the order of hundreds at room temperature. Direct measurements gave values of $\sigma_a = (2{\cdot}6 \pm 0{\cdot}2)10^4\,\Omega^{-1}\,\text{cm}^{-1}$ and σ_c between 150 and 230 $\Omega^{-1}\,\text{cm}^{-1} \pm 20\%$.

537.311.33 : 549.324.41 **165**

Properties of Point Contacts on Cobaltite.—G. G. E. Low. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 589–590.) Measurements are briefly reported which support the previously obtained result that point contacts on single crystals of CoAsS give symmetrical *I*/*V* characteristics, with peak voltages of 5–15 V in both directions of current flow. Pulse measurements confirm the view that the shape of the d.c. characteristic results from heat dissipation and consequent reduction of spreading resistance.

537.311.33 : [621.314.63 + 621.314.7](083.7) **166**

I.R.E. Standards on Electron Devices: Definitions of Semiconductor Terms, 1954.—(*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1505–1508.) Standard 54 I.R.E. 7S2.

537.311.33 : 621.314.632 **167**

The Theory of Rectification and Injection at a Metal-Semiconductor Contact.—J. B. Gunn. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 575–581.) "The diffusion equations for holes and electrons are solved for the region of a semiconductor near a planar contact with a metal, using assumptions appropriate to transistor-quality silicon and germanium. The hole and electron currents are calculated separately, and from them are obtained the rectification equation and injection ratio of the contact."

537.311.33 : 669.783 **168**

Germanium Technology.—J. M. Mercier. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 559–572.) A survey of the processes involved in modern methods of extraction, purification, reduction by crystallization or zone melting and the production of single crystals. 31 references.

537.525.8 : 539.231 **169**

Cathode Sputtering in Glow Discharges.—G. Ecker & K. G. Emeléus. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 546–552.) Discrepancies between experimental results and previously published theories are discussed, and a new formulation is presented which takes account of initial scattering, lateral boundaries, distribution of current over the cathode, high emission velocities, and the difference in mass between metal atoms and gas molecules.

538.221 **170**

Anhysteretic Magnetization of Alcomax III.—J. E. Gould & M. McCaig. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 584–586.) Curves obtained by measurements in the preferred and in the transverse direction are shown. The results indicate the practicability of magnetizing alcomax by a combination of direct and alternating fields.

538.221 **171**

Magnetically Oriented Structure in Permanent Magnets.—K. J. Kronenberg. (*Z. Metallkde*, July 1954, Vol. 45, No. 7, pp. 440–447.) Electron-microscope investigations of alnico (51% Fe, 24% Co, 14% Ni, 8% Al, 3% Cu) cooled from 950° to 750° in a magnetic field are reported. The resulting structure for material annealed at 800° is similar to that observed by Heidenreich & Nesbitt (2530 and 2531 of 1952). Examination of unannealed material revealed an oriented fine structure whose form and high dispersion confirm previous hypotheses of a magnetically significant structural anisotropy.

538.221 **172**

Factors determining the Permanent Magnet Properties of Single Crystals of Fe_2NiAl.—E. A. Nesbitt, H. J. Williams & R. M. Bozorth. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1014–1020.) The effect of the plate-like structure revealed by electron micrographs was investigated analytically and experimentally, using three models consisting respectively of (*a*) a single wire, (*b*) two mutually perpendicular wires, and (*c*) three mutually perpendicular wires embedded in lucite. Measurements were made of the torque on these models as a function of their orientation relative to an applied magnetic field. The results indicate that shape anisotropy of the precipitated particles is a major factor in determining the coercive force.

538.221 **173**

The Magnetic Properties of Alloys of Cobalt and Nickel with Palladium and Platinum.—E. P. Wohlfarth. (*Phil. Mag.*, June 1954, Vol. 45, No. 365, pp. 647–649.)

538.221 : [621.318.124 + 621.318.134 **174**

Ferromagnetism of Ferrite-Type Materials and Antiferromagnetism.—K. B. Vlasov & B. Kh. Ishmukhametov. (*Zh. eksp. teor. Fiz.*, July 1954, Vol. 27, No. 1(7), pp. 75–86.) A quantum-mechanics calculation is presented of the free energy and the magnetic equation of state for ferrites and antiferromagnetics.

538.221 : 621.318.134 **175**

Motion of Individual Domain Walls in a Nickel-Iron Ferrite.—J. K. Galt. (*Bell Syst. tech. J.*, Sept. 1954, Vol. 33, No. 5, pp. 1023–1054.) Samples were cut from a Ni-Fe ferrite so as to contain only one movable ferromagnetic domain wall. The viscous damping coefficient for this wall was measured as a function of temperature; the damping increases markedly as the temperature falls down to about 77°K. Existing theory is used to correlate the damping with the Landau-Lifshitz equation for the rotational motion of magnetization. The increase in the damping at low temperatures is attributed to a relaxation associated with a rearrangement of the valence electrons on the divalent and trivalent Fe ions. A tentative explanation of the losses is based on this mechanism.

538.221 : 621.372.413.029.64/.65 **176**

Ferromagnetic Resonance in Ferrites.—P. A. Miles. (*Nature, Lond.*, 24th July 1954, Vol. 174, No. 4421, pp. 177–178.) Report of studies made on polycrystalline specimens of the ferromagnetic systems $(1\text{-}x)(LiFe_5O_8)$ $x\,(CdFe_2O_4)$, $Li\,(Fe_{1-x}\,Al_x)_5O_8$, $Ni_{1-x}Zn_xFe_2O_4$ placed in resonant cavities operating at frequencies of 9·47, 23·94 and 34·4 kMc/s. The strength of an externally applied magnetic field necessary to induce peak resonance loss, and the resonance line width were studied as functions of frequency, specimen size and position of specimen along cavity axis.

538.614 : [621.318.124 + 621.318.134 **177**

Susceptibility Tensor and the Faraday Effect in Ferrimagnetics.—R. K. Wangsness. (*Phys. Rev.*, 15th July 1954, Vol. 95, No. 2, pp. 339–345.) Calculations for a ferrimagnetic with two sublattices are based on replacement of the gyromagnetic ratio for the single electron by the effective ratio for the material. The Faraday rotation changes sign as the temperature or composition of the material is varied through a point at which the magnetizations of the two sublattices are equal and opposite. The rotation for an unmagnetized antiferromagnetic is also determined, and results are generalized to cover an arbitrary number of sublattices.

539.23 : 535.215.1 **178**

Photoeffect in Thin Metal Films.—D. J. Fourie. (*Naturwissenschaften*, July 1954, Vol. 41, No. 14, pp. 328–329.) Continuation of work described previously (773 of 1954). Photoelectric emission from Cd, Te, Bi and Sn films on glass was investigated as a function of d.c. or a.c. flowing in the film. Results are shown graphically for a Te film with d.c. The different behaviour of the elements investigated is discussed in relation to their position in the periodic table.

621.315.612.6 : 537.52 **179**

The Impulse Breakdown Strength of Pyrex Glass.—J. Vermeer. (*Physica*, June 1954, Vol. 20, No. 6, pp. 313–326.)

621.315.613.1 **180**

Synthetic Mica Investigations: Part 4—Dielectric Properties of Hot-Pressed Synthetic Mica and Other Ceramics at Temperatures up to 400°C.—J. E. Comeforo & R. A. Hatch. (*J. Amer. ceram. Soc.*, 1st July 1954, Vol. 37, No. 7, pp. 317–322.) Continuation of work noted in 784 of 1954 (Comeforo et al.). Measurements were made of power factor and dielectric constant of a number of ceramic insulating materials at 1 Mc/s, and of the d.c. volume resistivity with a voltage of 22·5 V. The hot-pressed mica had the lowest loss factor at temperatures up to 200°C. The importance of determining the dielectric properties at the temperature of expected operation is emphasized.

621.315.616 **181**

Direct-Current Transients in Polymethyl Methacrylate and in Polystyrene.—P. Ehrlich. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1056–1058.) Measurements are reported and the relevance of the results to a.c. loss factor is discussed.

621.359.3 **182**

Centripetal and Centrifugal Electromagnetophoresis.— A. Kolin. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1065–1066.) Report on an experimental investigation in which observations were made of the rate of migration of polystyrene spheres with diameters of the order of 100 μ suspended in NaCl solutions. Techniques eliminating convection were evolved.

621.68.01 **183**

Valveless Pump Action.—G. Liebau. (*Naturwissenschaften*, July 1954, Vol. 41, No. 14, p. 327.) A pump action is produced in a system of pipes of different diameters by applying periodic pressure pulses at a point along the wider pipe. The action results from turbulent flow.

621.885 : 621.3 **184**

Stress Systems in the Solderless Wrapped Connection and their Permanence.— W. P. Mason & O. L. Anderson. (*Bell Syst. tech. J.*, Sept. 1954, Vol. 33, No. 5, pp. 1093–1110.)

666.22 : 546.244-31 **185**

Dielectric Properties of Tellurite Glasses.—J. P. Poley. (*Nature, Lond.*, 7th Aug. 1954, Vol. 174, No. 4423, p. 268.) Continuation of investigation reported by Stanworth (2834 of 1952). Measurements at frequencies up to 24 kMc/s indicate that the dielectric properties are frequency independent.

MATHEMATICS

512.3 **186**

A Neglected Method for Resolution of Polynomial Equations.—W. C. Taylor, Jr. (*J. Franklin Inst.*, June 1954, Vol. 257, No. 6, pp. 459–464.) Bernoulli's method is explained, with examples; for a wide variety of problems it is quicker than other methods, assuming a desk calculator is available.

512.393 **187**

Solution of Cubics and Quartics.—A. C. Sim. (*Wireless Engr*, Nov. 1954, Vol. 31, No. 11, pp. 294–300.) "A routine for the determination of the roots of cubic equations is developed specifically to meet the requirements of circuit designers. The method is based upon that used by Emde and is organized so that the solutions are developed with minimum effort. Three significant figures can be obtained using a slide-rule for the subsidiary computations. Ferrari's method for reducing a quartic equation is utilized to develop a similar routine to determine the quadratic factors. Simple checks are provided at appropriate stages in the routines, and a few numerical examples are included. A collection of cubic and quartic Laplace Transforms is appended."

512.83 **188**

The Distribution of Random Determinants.—H. Nyquist, S. O. Rice & J. Riordan. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, pp. 97–104.) Random determinants are considered whose elements are independent random variables having a common distribution which is symmetrical about zero and has unit variance. These determinants arise in considering the problem of solving large systems of linear equations on an automatic computer, and have a bearing on the relation between the computer precision and the order of the largest system which should be tried.

517 **189**

The Operational Calculus of Legendre Transforms.—R. V. Churchill. (*J. Math. Phys.*, July 1954, Vol. 33, No. 2, pp. 165–178.)

517 **190**

The Monte Carlo Solution of some Integral Equations.—E. S. Page. (*Proc. Camb. phil. Soc.*, July 1954, Vol. 50, Part 3, pp. 414–425.) "Estimators are given for the solution by Monte Carlo methods of the Fredholm integral equation of the second kind and the variances of the estimators are compared. Two integral equations arising in sequential analysis are considered in detail; some numerical examples are given."

517.43 **191**

Elementary Observations on Symbolic Calculus.—F. H. Raymond. (*Ann. Télécommun.*, July/Aug. 1954, Vol. 9, Nos. 7/8, pp. 194–196.) Abel's theorem is presented in a form of practical importance. A fundamental form of the superposition theorem is derived from the postulate of linearity.

512.14 (083.4) **192**

50–100 Binomial Tables. [Book Review]—H. G. Romig. Publishers: J. Wiley, New York, and Chapman & Hall, London, 1953, 172 pp., $4. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, p. 206.) The value of the individual terms and the sum of the first x terms of $[P + (1 - P)]^n$ are given for n in the range 50–100 in steps of 5 and P in the range 0·01–0·50 in steps of 0·01 to six decimal places, the last place being doubtful.

517 **193**

Complex Variable Theory and Transform Calculus. [Book Review]—N. W. McLachlan. Publishers: University Press, Cambridge, 2nd edn 1953, 388 pp., 55s. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, p. 591.) Deals with the use of Laplace transforms and the Mellin inversion theorem in solving certain types of differential equation which arise in technical problems. A wide range of applications, including electrical circuits, is discussed.

517.9 **194**

Numerical Solution of Differential Equations. [Book Review]—W. E. Milne. Publishers: Chapman & Hall, London, 1953, 275 pp., 52s. (*Sci. Progr.*, July 1954, Vol. 42, No. 167, p. 510.)

MEASUREMENTS AND TEST GEAR

621.317.3 : 621.314.7 **195**

The Measurement of the Small-Signal Characteristics of Transistors.—E. H. Cooke-Yarborough, C. D. Florida & J. H. Stephen. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 288–293. Discussion, pp. 308–313. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, p. 569.) A.c. bridge circuits are used, the transistor characteristics being derived from the setting of decade resistance boxes adjusted to give zero reading on a c.r.o. indicator. Emitter current values ranged from 1 μA to several milliamperes. Results can be used to determine the sensitivity and stability of transistor trigger circuits.

621.317.3 : 621.372.5.012 **196**

Experimental Procedures for Determining the Efficiency of Four-Terminal Networks.—H. F. Mathis. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 982–986.) Various procedures are presented based on plotting circle loci in the impedance or reflection-coefficient plane.

621.317.3 : 621.376.2 **197**

The Calibration of Amplitude-Modulation Meters with a Heterodyne Signal.—J. R. Macdonald. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1515–1518.) "Errors which may occur in the calibration of peak or average reading amplitude modulation meters with a heterodyne signal are investigated in detail. Relations between the heterodyne-amplitude ratio M and the true modulation factor m of a sinusoidally modulated wave are derived. Using these results, heterodyne calibration of modulation analyzers to read m exactly can readily be carried out."

621.317.328 : 621.372.413 **198**

The Measurement of Electromagnetic Field in Resonant Cavities by Introduction of Small Metallic Rings.—A. Gilardini. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1064–1065.) A variant of the method described by Maier & Slater (2265 of 1952) is discussed.

621.317.33 : 621.372.413 **199**

Measurement of Resonant-Cavity Characteristics.—G. L. Hall & P. Parzen. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol 42, No. 10, p. 1495.) Correction to paper abstracted in 799 of 1954.

621.317.332.029.64 **200**

A Method for the Measurement of Conductivity of Metals at Microwave Frequencies.—S. K. Chatterjee, P. R. Shenoy & C. R. Bai. (*J. Indian Inst. Sci.*, Section B, July 1954, Vol. 36, No. 3, pp. 107–122.) Theory and experimental details of a method of determining the conductivity from measurements of the reflection coefficient are given. The reflection coefficient is expressed in terms of the v.s.w.r., attenuation constant, scattering coefficient of discontinuities which may be present in the waveguide system, and phase factors. Results for silver, copper and brass, at a frequency of 9·6979 kMc/s are in fair agreement with values obtained by Beck & Dawson (394 of 1951). The conductivity of duralumin was also determined.

621.317.335.3.029.64 : 535.325 **201**

Some Measurements on Refractive Indices of Gases in the Microwave Region.—F. W. Heineken & F. Bruin. (*Physica*, June 1954, Vol. 20, No. 6, pp. 350–360.) A method is described in which a measurement is made of the change in the length of a resonant cavity required to keep the cavity tuned to the ammonia absorption line at about 25 kMc/s on replacing a filling of nitrogen with a filling of the gas under test. Results are given for ten gases.

621.317.335.3.029.64 : 535.325 : 546.217 **202**

Measurement of Refractive Indices of Air, Nitrogen, Oxygen, Carbon Dioxide and Water Vapour at 3 360 M/cs.—W. Jasinski & J. A. Berry. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 337–343.) A frequency-modulation technique comparable with that of Birnbaum et al. (1426 of 1951) was used to measure the change in resonance frequency of an evacuated cavity on filling it with a gas. A c.r.o. displays (*a*) the cavity resonance curve and (*b*) pairs of pulses indicating the carrier frequency and two sideband frequencies derived from modulation of a 3·36-kMc/s signal by a standard signal generator. The signal-generator frequency is adjusted until the peak of the resonance curve falls in the middle of one pair of the sideband pulses; to increase the accuracy of this adjustment, horizontal markers derived from these pulses are superposed on the resonance curve. The signal-generator frequency is then accurately measured by a wavemeter, and addition to or subtraction from the carrier frequency gives the cavity resonance frequency. Estimated accuracies are within ± 2 parts in 10^7 for dry CO_2-free air, nitrogen and oxygen, $\pm 3{\cdot}5$ parts in 10^7 for CO_2, and ± 1 part in 10^7 for water vapour. The precautions observed and the errors involved are considered in detail.

621.317.336.029.6 **203**

Impedance Measurement by means of a Broadband Circular-Polarization Coupler.—S. B. Cohn. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1554–1558.) A section of circular waveguide is arranged perpendicular to a rectangular waveguide and is coupled to it by three slots in Π formation in its wide side. TE_{10} waves travelling in the rectangular guide excite TE_{11} waves in the circular guide with circular polarization whose sense depends on the direction of the exciting wave. A probe rotated through one turn in the circular guide samples a field variation exactly equivalent to that in one guide wavelength of the rectangular guide. Operation over a bandwidth of about 20% is possible.

621.317.34 **204**

Pulse Analysis of Cables and its Developments.—J. Oudin. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 573–583.) A survey of the technique covering basic measurement equipment, and the special requirements for pulse tests over long distances. The improvement in signal/noise ratio required for long-distance work may be obtained by passing the received signal through an optimum filter of the Wiener type, involving pulse switching and integration. Current applications of the technique are also reviewed.

621.317.342.018.782.3 : 621.397.62 **205**

An Instrument for measuring Group Delay.—H. J. de Boer & A. van Weel. (*Philips tech. Rev.*, May 1954, Vol. 15, No. 11, pp. 307–316.) The group delay of a video signal in a television receiver is measured accurately to within 10^{-9} sec by an arrangement constituting a sensitive phase-difference meter. The phase shift to be measured controls the frequency of an oscillatory circuit; change in the oscillation frequency is converted into a voltage variation by means of a discriminator. Results of some measurements are reported.

621.317.361 : 621.396.822 **206**

Short-Time Frequency Measurement of Narrow-Band Random Signals in the Presence of Wide-Band Noise.—P. M. Schultheiss, C. A. Wogrin & F. Zweig. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1025–1036.) Comparison of the performance of the autocorrelator and the frequency discriminator in regard to the accuracy attainable in measuring the centre frequency of a symmetrical power spectrum within a given short time interval. When both systems are adjusted for optimum operation at a given signal/noise ratio, their performances are closely equivalent. For operation in conditions other than optimum the discriminator is preferred on account of its flat characteristic. The effect of filter adjustment is examined.

621.317.4 **207**

The Flux Linkage with a Search Coil produced by a Coaxial Uniformly Magnetized Prolate Spheroid.—G. H. Hunt. (*Brit. J. appl. Phys.*, July 1954, Vol. 5, No. 7, pp. 260–263.) The expression for the flux enclosed by the search coil takes the form of a power series with coefficients which can readily be calculated from mathematical tables.

621.317.7 : 621.372.8 **208**

Bibliography of Directional Couplers.—R. F. Schwartz. (*Trans. Inst. Radio Engrs*, July 1954, Vol. MTT-2, No. 2, pp. 58–63.) About 100 references are listed.

621.317.7 : 621.396.82 : 551.594.6 **209**

Measurement of Atmospheric Noise Interference to Broadcasting.—Chandrashekhar Aiya. (See 257.)

621.317.715 **210**

A Note on the Use of the Ballistic Galvanometer.—G. F. Tagg. (*Instrum. Practice*, July 1954, Vol. 8, No. 7, pp. 609–610.) A correction factor applicable for any value of damping is given.

621.317.729 : 681.142 **211**

The "Mechanical Particle", an Analog Computing Machine.—Rankin. (See 38.)

621.317.73/.74 : 621.315.212 **212**

The Development of a Precision Termination for 0·375-in. Polythene-Disc-Insulated Coaxial Cable.—R. J. Cheetham, E. L. Mather & W. W. H. Clarke. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 347–349.) Digest of 2178 of 1954.

621.317.733 : 621.314.7 **213**

A Bridge for measuring the A.C. Parameters of Point-Contact Transistors.—A. R. Boothroyd & S. K. Datta. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 294–297. Discussion, pp. 308–313. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, p. 570.) A bridge for measuring the a.c. parameters at 1 kc/s for chosen d.c. conditions is described, which is based on the comparison of the transistor with a practical representation of its a.c. equivalent-T circuit. Accuracy obtainable is within $\pm 3\%$.

621.317.733 : 621.314.7 **214**

A Bridge for measuring the A.C. Parameters of Junction Transistors.—A. R. Boothroyd & J. Almond. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 314–316. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 570–571.) A simple arrangement for measuring the low-frequency parameters under emitter-open-circuit and collector-short-circuit conditions is described. The parameters measured are those suggested by Knight et al. (3358 of 1953). Accuracy obtainable is within $\pm 4\%$.

621.317.733 : 621.316.86 : 537.312.6 **215**

A Simple Direct-Reading Thermistor Bridge.—D. C. Cooper. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 448–451.) The instrument described is suitable for measuring microwave power up to 1 mW; the current in the indicating instrument is 400 μA at this power level.

621.317.755/.756 **216**

The Dampometer.—C. O. Olsson & K. Orlik-Rückemann. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 420–428.) An arrangement for automatically recording logarithmic decrement and oscillation frequency at audio and lower frequencies is based on the representation of the damped oscillation by a rotating vector on the screen of a c.r.o., the rate of decrease of the length of the vector constituting a measure of the damping. The screen is covered by a radially slotted disk, and a photocell is arranged to receive light pulses as the screen spot passes the slots. Results are obtained in the form of decimal digits inversely proportional to the logarithmic decrement and the frequency respectively. The apparatus has been used in Sweden for measurements on aeroplane models in wind tunnels.

621.317.755 **217**

A Large Magnetically-Deflected Oscilloscope.—P. E. K. Donaldson. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 442–444.) Details are given of a c.r.o. designed for demonstrating biological phenomena in a large lecture theatre; a large-screen c.r. tube is operated as slave to an oscilloscope tube of usual size.

621.317.755 : 537.533 **218**

Ultra-high-Frequency Beam Analyzer.—L. R. Bloom & H. M. VonFoerster. (*Rev. sci. Instrum.*, July 1954, Vol. 25, No. 7, pp. 649–653.) Electron beams modulated at u.h.f., e.g. as in klystrons, are studied by means of a c.r.o. in which the deflection system comprises two mutually perpendicular pairs of Lecher wires resonating at the beam-modulation frequency. With proper adjustment a circular trace is obtained. In a particular system described, the electron-velocity resolution was about 30 V, but by increasing the length of the drift space between the pairs of wires the sensitivity could be made high enough to measure the velocity spread in an unmodulated beam.

621.317.755 : 621-526 **219**

The Transferometer.—R. Landrin. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 594–602.) A c.r.o. instrument for determining points on the gain/frequency and phase/frequency curves of servomechanisms or servo elements.

621.317.78.029.64.089.6 **220**

The Comparison and Calibration of Power-Measuring Equipment at Wavelengths of 3 cm and 10 cm.—R. A. Bailey, H. A. French & J. A. Lane. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 325–329.) Two sets of substandard equipment designed to measure power of about 1 mW are described, one for each wave-band; each consists basically of a thermistor mount, a power unit and an output meter. The accuracy of the final calibration carried out at wavelengths of 3·18 and 10·77 cm is estimated at $\pm 2\%$ and $\pm 1\%$ respectively. The 3-cm equipment was calibrated in terms of two different standards, the water calorimeter and the torque-operated vane wattmeter [1082 of 1953 (Cullen & Stephenson)]; good agreement was obtained.

621.317.791 **221**

Automatic Circuit Tester speeds Production.—R. J. Stahl & G. R. West. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 136–139.) Description of equipment comprising a universal unit, containing basic measurement circuits and controls, together with a plug-in adapter unit, containing programming and selector devices. The selector switch is advanced one step on receiving information from the measurement element that the previous test is satisfactorily completed.

621.317.794 **222**

Absolute Water Flow Calorimeter for the Measurement of Intense Beams of Radiant Energy.—A. B. Willoughby. (*Rev. sci. Instrum.*, July 1954, Vol. 25, No. 7, pp. 667–670.) The instrument was designed primarily for measurements on a searchlight radiating energy of the order of 100 cal cm^{-2} sec^{-1}. The heating effects produced on two identical blackbody receivers by the unknown energy and by an electrical coil are balanced.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.1-8 : 531.717.1 **223**

An Ultrasonic Method of Gauging.—F. M. Savage. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No 9, pp. 436–444. Discussion, p. 444.) A method is described for measuring wall thickness when only one surface is accessible. Standing waves are set up between the two surfaces of the wall and current peaks are observed as the frequency of the generator is varied through values corresponding to an integral multiple of λ/2; the thickness is calculated from the frequency interval between successive peaks. Details of two instruments are discussed.

534.1-8 : 616-006 **224**

On the Use of Ultrasound for Tumor Detection.—H. T. Ballantine, Jr, T. F. Hueter & R. H. Bolt. (*J. acoust. Soc. Amer.*, July 1954, Vol. 26, No. 4, p. 581.) The possibility of using ultrasonic shadow technique for examining brain structure has been investigated. Results indicate that the information obtainable about abnormalities is limited by scattering and refraction associated with normal inhomogeneities in skull and brain.

621.3.018.75 : 621.383 **225**

Automatic Particle-Sizing by Successive Counting.—G. Jordanides & N. H. Chamberlain. (*Nature, Lond.*, 10th July 1954, Vol. 174, No. 4419, pp. 83–84.) A specimen under examination, sandwiched between glass disks, is rotated and scanned spirally by a photoelectric head of usual type, the size of the scanning spot being such that particles may give rise to more than one pulse each. The photocell output, consisting of pulses of various heights, is passed after linear amplification through a clipping circuit. By repeating the process with different clipping levels and plotting counts against clipping level, both the number of particles and their average diameter can be determined.

621.316.7.002 : 621.374 : 621.396.82 **226**

Coincidence of Pulse Trains.—Friedman. (See 252.)

621.317.39 : 539.32 **227**

Electroacoustic Measurements of Elastic Modulus.—A. Bressi. (*Alta Frequenza*, April 1954, Vol. 23, No. 2, pp. 51–61.) The elastic modulus of a concrete prism is evaluated from the velocity of propagation of elastic waves in the material, as determined by a resonance method. Vibrations are excited by means of a 15-W loudspeaker unit and are detected by means of a telephone-type electromagnet arranged to face an iron plate fixed to the end of the test specimen. Resonance is indicated by a valve voltmeter, and a c.r.o. indication is also provided.

621.317.39 : 539.32 **228**

An Improved Method of Measuring Dynamic Elastic Constants, using Electrostatic Drive and Frequency-Modulation Detection.—H. Pursey & E. C. Pyatt. (*J. sci. Instrum.*, July 1954, Vol. 31, No. 7, pp. 248–250.) Details are given of an arrangement which permits rapid and precise measurement of the natural resonance frequencies of metal bar specimens, from which the elastic moduli can be determined with an accuracy to within 1–2‰.

621.384.6 **229**

Electronic-Ram Experiments.—I. J. Billington & W. R. Raudorf. (*Wireless Engr*, Nov. 1954, Vol. 31, No. 11, pp. 287–292.) A description is given of apparatus designed on principles discussed previously [2788 of 1951 (Raudorf)]. A 100-mA rotating cylindrical electron beam is produced; the axial velocity, space-charge density and cross-sectional area are controlled by a steady axial magnetic field. The results confirm that a ram effect is produced by the braking of the beam on entering a region of rapidly increasing magnetic-field intensity.

621.384.612 : 517.572.4 **230**

Asymptotic Properties of Bessel Functions and the Radiation from a Synchrotron.—D. Park. (*J. Math. Phys.*, July 1954, Vol. 33, No. 2, pp. 179–184.) An investigation is made of the behaviour of the Bessel function occurring in the formula for the power radiated from the synchrotron, over a critical range at high orbital frequencies.

621.384.613 **231**

A Pulsed Magnetic Extractor for removing the Electron Beam from a Betatron.—R. S. Foote & B. Petree. (*Rev. sci. Instrum.*, July 1954, Vol. 25, No. 7, pp. 694–698.) Description of the device used with the N.B.S. betatron.

621.384.622.2 **232**

An 8-MeV Linear Accelerator for X-ray Therapy.—C. W. Miller. (*Proc. Instn elect. Engrs*, Part I, July 1954, Vol. 101, No. 130, pp. 207–219. Discussion, pp. 219–222.) An account is given of the four-year programme of research and development leading to the installation of the X-ray machine at Hammersmith Hospital. 8-MV X-rays are obtained by accelerating electrons in a corrugated waveguide, of length 3 m, energized by a magnetron giving a pulsed output of peak power about 2 MW at a free-space wavelength of 10 cm.

621.385.833 **233**

The Adjustment of Electron-Optical Filter Lenses.—O. Rang. (*Optik, Stuttgart*, 1954, Vol. 11, No. 7, pp. 327–334.) The method used for adjusting velocity-filter lenses [461 of 1952 (Möllenstedt & Rang)] is described.

621.385.833 **234**

Third-Order Aberrations of 'Doubly Symmetric' Systems.—J. C. Burfoot. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 523–528.) Imaging systems are considered which retain symmetry about each of two mutually perpendicular planes while lacking rotational symmetry. The third-order aberrations are classified and presented diagrammatically for the case of a circular exit aperture.

621.385.833 **235**

Theory of the Independent Electrostatic Lens with Thick Middle Electrode.—P. Ehinger & M. Y. Bernard. (*Cah. Phys.*, July 1954, No. 50, pp. 8–16.) Analysis is given for a three-diaphragm electron lens, the thickness of the middle diaphragm being large compared with the diameter of the aperture. The potential distribution along the axis is calculated, and the position of the cardinal points hence derived. The accuracy of the method is confirmed by comparing the results with observations.

621.385.833 **236**

The Lower Limit of the Aperture Error in Magnetic Electron Lenses.—W. Tretner. (*Optik, Stuttgart*, 1954, Vo. 11, No. 7, pp. 312–326.) A variational method is used to find the lower limit set to the values of the lens excitation parameters by the saturation of the iron and the degree of mechanical imperfection.

621.385.833 237

On the Chromatic Field Aberration of the Magnetic Electron Lens in the Electron Microscope.—N. Morito. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 986–993.) Analysis is presented; observed results support the theory.

621.385.833 : 061.3(47) 238

Session of the Physical-Mathematical Section of the U.S.S.R. Academy of Sciences and the β-γ Spectroscopy Conferences 1950, 1953 and 1954.—(*Bull. Acad. Sci. U.R.S.S., sér. phys.*, March/April 1954, Vol. 18, No. 2, pp. 173–246.) The text is given of papers dealing with various aspects of focusing by magnetic electron lenses.

621.387.4 : 531.7 239

The Alpha Gauge.—E. N. Shaw. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No. 9, pp. 414–418. Discussion, p. 433.) "The apparatus described is for the measurement of weight per unit area of very thin materials, such as capacitor paper. An alpha source is used in conjunction with an ionization chamber backed off by a similar system. The algebraic sum of the currents is fed into a stable d.c. amplifier, and the out-of-balance reading calibrated in terms of weight. The sources of error are investigated, together with methods of compensation. Results obtained under factory conditions are also discussed."

621.387.4 : 531.7 240

A Combined Beta and Dielectric Gauge.— R. Y. Parry. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No. 9, pp. 427–432. Discussion, p. 433.) By combining the two gauges in a single installation, an equipment is obtained having long-term stability and rapid response.

621.387.4 : 531.717.1 241

A Gamma-Ray Thickness Gauge for Hot Steel Strips and Tubes.—G. Syke. (*J. Brit. Instn Radio Engrs*, Sept. 1954, Vol. 14, No. 9, pp. 419–426. Discussion, p. 433.) A gauge for steel strip of thickness 0·05 to 0·30 in. is described, using a scintillation detector and providing readings at short time intervals. An adaptation for gauging the wall thickness of tubes is also discussed.

PROPAGATION OF WAVES

538.566 242

Validity of the Sommerfeld-Pfrang Reciprocity Theorem [for e.m. wave propagation] **in Absorbing Media.**—C. v. Fragstein. (*Optik, Stuttgart*, 1954, Vol. 11, No. 7, pp. 301–311.)

538.566 : 551.594.6 243

The Propagation of Long Waves from a Horizontal Dipole in the Air Space between Earth and Ionosphere.—W. O. Schumann. (*Z. angew. Phys.*, May & June 1954, Vol. 6, Nos. 5 & 6, pp. 225–229 & 267–271.) Detailed analysis of propagation between the earth and an ionosphere of finite conductivity to determine the radiation field at frequencies above and below certain critical values. Principal radiation is in the H mode transverse to the dipole direction, and the assumption of a vertical-magnetic-dipole equivalent is justified. E-mode components propagated in the direction of the dipole are only significant at very low frequencies. See also 1544 and 2195 of 1954.

621.396.11 : 551.510.535 244

Maximum Usable Frequencies and Lowest Usable Frequencies for the Path Washington to Resolute Bay.—S. M. Ostrow. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, p. 434.) Comment on 1889 of 1954 (Hanson et al.).

621.396.11 : 551.510.535 245

Experiments on Interaction of Radio Waves in the Ionosphere.—M. Boella. (*Nuovo Cim.*, 1st July 1954, Vol. 12, No. 1, pp. 140–142.) Discussion of investigations reported by Cutolo (1167 and 2084 of 1954, etc.). Reasons are given for considering it unlikely that the value of the earth's magnetic field in the upper atmosphere can be determined from electron gyromagnetic effects with an accuracy as good as has been suggested. A possible method of investigating self-demodulation is indicated by periodically varying the power of the radio transmission while maintaining the carrier and modulation frequencies constant.

621.396.11.029.51 246

A Technique for Sweep-Frequency Polarization Measurements at Low Frequencies.—E. L. Kilpatrick. (*J. geophys. Res.*, Sept. 1954, Vol. 59, No. 3, pp. 345–349.) A technique for simultaneously recording the polarization of echoes and ionosphere virtual height is described. The polar and phase diagrams of each echo are recorded on photographic film with displacement in one direction proportional to virtual height and in the other direction proportional to frequency. A block diagram of the equipment and specimen records are shown.

621.396.11.029.55 247

A Rotating Interferometer for the Measurement of the Directions of Arrival of Short Radio Waves.—H. A. Whale. (*Proc. phys. Soc.*, 1st July 1954, Vol. 67, No. 415B, pp. 553–562.) Two horizontal loop aerials are used, one of which is fixed while the other moves in a circular path several wavelengths in diameter. The phases of the signals from the two aerials are compared in a system which gives an output voltage approximately proportional to $A_1A_2\cos\phi$, where A_1 and A_2 are the amplitudes of the two signals and ϕ is the phase angle between them. The output thus has zero value when $\phi = \pm 90°$, irrespective of the amplitudes, so that the method is useful even when there is considerable differential fading. Some experimental records are shown (in a plate separated from the text).

621.396.11.029.6 : 551.5 248

Influence of Weather Conditions on the Characteristics of U.S.W. Long-Distance Reception.—E. A. Lauter & L. Klinker. (*Z. Met.*, July/Aug. 1954, Vol. 8, Nos. 7/8, pp. 222–230.) Field-strength records for propagation over land and sea paths over several years are analysed. Three characteristic types of reception are distinguished, (*a*) stable, (*b*) slow fading, (*c*) scintillation fading; transitional types are also recognized. Stable reception with relatively high mean field strength is predominant during anticyclonic conditions; scattering phenomena coupled with low field strength are observed during cyclonic conditions. Seasonal differences in the frequency of occurrence of the different types of reception are caused by variations in the structure of the lower atmosphere.

621.396.11.029.62/.64 249

The Propagation of Metre and Centimetre Waves (Wavelengths between 6 m and 3 cm). Determination of the Transmission Equivalent.—J. Ortusi. (*Ann. Radioélect.*, July 1954, Vol. 9, No. 37, pp. 227–273.) Propagation over both direct-visibility and long-distance paths is considered. Characteristics studied include received power, attenuation and the effect of mountains. Relevant diffraction theory and the measurement of turbulence fields are considered in appendices. The results are summarized for convenient use in a series of ten nomograms, covering received power, transmission equivalent, attenuation, maximum range and effective aerial height.

621.396.11.029.62 : 523.5 **250**

Dependence of Integrated Duration of Meteor Echoes on Wavelength and Sensitivity.—D. W. R. McKinley. (*Canad. J. Phys.*, July 1954, Vol. 32, No. 7, pp. 450–467.) "The reflecting properties of short-duration and long-duration echoes from meteor trails are examined. For short-duration echoes only, the observed relation between relative numbers and durations of meteor echoes is independent of wavelength, the time of day, or the presence of a strong shower. Integrated duration times are determined from back-scatter experiments on 9·22 m, 5·35 m, and 2·83 m, and are found to vary with the 3·5th power of the wavelength, for either short- or long-duration echoes. The integrated echo power depends on the 6th power of the wavelength. The effect of changing the equipment sensitivity is considered. The data from the back-scatter observations are used to predict the integrated duration times in the forward-scatter case, and in particular, it is shown that the results of the Cedar Rapids–Sterling very-high-frequency experiment may be explained by meteoric reflections."

621.396.11.029.63/.64 **251**

Investigation of Centimetre-Wave Propagation in the Mediterranean Region.—P. Chavance, L. Boithias & P. Blassel. (*Ann. Télécommun.*, June 1954, Vol. 9, No. 6, pp. 158–185.) Report of tests carried out since April 1952. These included field-strength recordings of vertically and horizontally polarized transmissions at 1·4 and 3·15 kMc/s over a 227-km sea path; psychrometer measurements in aircraft; simultaneous beamed transmissions on 3·15 kMc/s between four stations roughly in the same vertical plane; diversity reception; transmissions at 4 and 9·2 kMc/s over a 29-km path. A full description is given of the equipment used, and results are analysed and discussed. Main conclusions are: (*a*) multipath propagation is often the predominant cause of fading over long sea paths, height-diversity reception being a particularly effective remedy; (*b*) over short sea paths reflection effects are preponderant, high-gain narrow-beam aerials improving reception considerably.

RECEPTION

621.374 : 621.396.82 : 621.316.7.002 **252**

Coincidence of Pulse Trains.—H. D. Friedman. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1001–1005.) Extension of investigation described by Miller & Schwarz (238 of 1954). Alternative methods are presented for determining the coincidence time fraction for simple or complex pulse trains with commensurable periods. A determination is made of the largest possible error resulting from direct use of elementary probability theory when considering three or more pulse trains. The theory is relevant to a variety of problems including communications and control of manufacturing operations.

621.376.23 : 621.396.822 **253**

The Joint Distribution of *n* Successive Outputs of a Linear Detector.—W. C. Hoffman. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1006–1007.) "The joint probability density function of *n* successive outputs of a linear detector is derived for the case of dependent Gaussian inputs."

621.396.62 : 621.396.822 **254**

On the Distributions of Signals and Noise after Rectification and Filtering.—M. A. Meyer & D. Middleton. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 1037–1052.) A generalization of the method presented by Kac & Siegert (3645 of 1947) is used to find the probability density for wide-band and for narrow-band signals with random noise, after passage through a square-law rectifier and an audio or video filter. Explicit solutions are obtained for an integral equation involving the autocorrelation function of the noise, the weighting function of the filter, and an orthonormal set of eigenfunctions.

621.396.62 + 621.397.62].002.2 **255**

Dip-Soldered Chassis Production.—W. R. Cass & R. M. Hadfield. (*Wireless World*, Nov. 1954, Vol. 60, No. 11, pp. 536–539.) An account of the use of the dip-soldering technique in conjunction with printed circuits to simplify the manufacture of sound and television receivers.

621.396.621 **256**

Notes on the History of the Broadcast Receiver.—C. Dorsman. (*Tijdschr. ned. Radiogenoot.*, July 1954, Vol. 19, No. 4, pp. 179–210.) Development of the radio receiver is traced from the invention of the Leyden jar; special emphasis is laid on the work of Maxwell, Hertz and Marconi. 40 references.

621.396.82 : 551.594.6 : 621.317.7 **257**

Measurement of Atmospheric Noise Interference to Broadcasting.—S. V. Chandrashekhar Aiya. (*J. atmos. terr. Phys.*, Sept. 1954, Vol. 5, No. 4, pp. 230–242.) A criterion for assessing the annoyance value of noise in broadcast reception is established, based on investigations carried out in India over a period of several years. Taking into account the statistical variation of the duration of noise pulses, the lowest number of pulses per minute causing annoyance is ten. Objective measurements were made using a noise meter of the rapid-charge slow-recovery type; charging and discharging time constants of 10 ms and 500 ms respectively gave the closest agreement between the measured noise and the subjective results. Correlation was satisfactory for the greater part of the time, but for pulses lasting about 0·1 sec or less the meter reading was too high. No data are available for pulses longer than 0·4 sec. The design and calibration of noise-measurement equipment are considered and methods of recording and analysing observations are discussed.

STATIONS AND COMMUNICATION SYSTEMS

621.376.2 **258**

A General Solution of the Two-Frequency Modulation Product Problem: Part 3—Rectifiers and Limiters.—R. L. Sternberg. (*J. Math. Phys.*, July 1954, Vol. 33, No. 2, pp. 199–205.) Theory developed in part 1 [2212 of 1954 (Sternberg & Kaufman)] and functions tabulated in part 2 (3028 of 1954) are used to obtain exact expressions for the amplitudes of the modulation products for ideal rectifiers and limiters having continuous polygonal output/input characteristics.

621.376.3 : 621.396.822 **259**

The Power Spectrum of a Carrier Frequency-Modulated by Gaussian Noise.—J. L. Stewart. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1539–1542.) A modification of Middleton's method (see e.g. 802 of 1952) is used to obtain expressions for the power spectra for particular types of modulating signal.

621.39.001.11 **260**

Optimum Coding for Maximum Repeater Spacing.—D. G. Holloway. (*A.T.E. J.*, July 1954, Vol. 10, No. 3, pp. 188–198.) "The signals carried by a communications circuit may be recoded to occupy either more or less bandwidth without alteration to the amount of information. The selection of a preferred type of coding depends largely on the frequency characteristics of the transmission medium, and the practical limitations of transmitters and receivers impose other bounds. The increase of cable attenuation with frequency has a marked effect on the choice of coding for cable circuits, and it is found that binary coding is seldom desirable, for a multi-level system generally permits greater repeater spacing. To obtain the optimum conditions it may be necessary to recode signals to occupy a smaller bandwidth, with a consequent need to improve the accuracy of circuit equalization."

621.391.64 : 621.376.22 : 546.289 **261**

Germanium Modulator for Infrared Communication.—A. F. Gibson. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 155–157.) A beam of infrared radiation is modulated by an electronic shutter comprising a small block of Ge whose infrared transparency is varied by injection of charge carriers under control of an a.f. signal. Practical details are given for a modulator with a frequency response 3 db down at about 9·5 kc/s. A tungsten-filament lamp is used as power source and a PbS cell as receiver.

621.395.44 **262**

Twelve-Channel Systems on Non-Pupinized Pairs of the Verona-Brennero Cable.—G. Saraco. (*Alta Frequenza*, April 1954, Vol. 23, No. 2, pp. 62–78.) The carrier-current telephony system described operates over some 200 km of symmetrical-pair cables. Channel bandwidth is 4 kc/s and frequency bands 6–54 kc/s and 60–108 kc/s are used for transmission in the two directions respectively. The choice of these frequency bands is discussed. Details of modulation and repeater-station equipment and performance figures are given.

621.396.65 **263**

Automatic Testing of V.H.F. Radio Links.—E. Petrozzi. (*Alta Frequenza*, April 1954, Vol. 23, No. 2, pp. 102–106.) The central station of a mobile v.h.f. network sends out a short modulated pulse at regular intervals; an automatic response is obtained from the peripheral stations if they are connected. Descriptions, with circuit diagrams, are given of arrangements suitable for testing duplex and simplex systems.

621.396.65 **264**

Miniature U.S.W. Radio Link.—H. J. Fründt. (*Telefunken Ztg*, July 1954, Vol. 27, No. 104, pp. 88–96.) Transmitter, receiver and frequency-transposition units are described for a low-cost transportable radio link. Three telephone channels are provided and operation is in the 80- and 160-Mc/s bands. The S/N ratio of 40 db is achieved even with two intermediate relay stations. The equipment differs only slightly from standard mobile telephone equipment for the same frequency bands, and is designed to be used in various ways in conjunction with such equipment.

621.396.65 + 621.396.96] : 621.396.677.3 **265**

The Application of [u.h.f.] **Radio Beams to Radar, Multiplex and Television Techniques.**—Aubert. (See 30.)

621.396.932 **266**

The Technical Equipment of Ship Radio Stations.—W. Böttcher. (*Elektrotech. Z., Edn B*, 21st July 1954, Vol. 6, No. 7, pp. 285–290.) Ship radio installations provide aids for communication and navigation purposes, and operate under conditions prescribed by international agreements. These general conditions are outlined, and the minimum equipment to be carried on ships of certain classes of size is specified. Typical transmitters, receivers, and navigation equipment are briefly described.

SUBSIDIARY APPARATUS

621-526 **267**

The "Least Squares" Criterion applied to Linear Servos.—R. Voles. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 452–453.)

621-526 **268**

Transient Performance of Servomechanisms.—R. C. Lathrop & D. Graham. (*Elect. Engng, N.Y.*, July 1954, Vol. 73, No. 7, p. 620.) Digest of paper published in *Trans. Amer. Inst. elect. Engrs*, 1954, Vol. 73, Part II, *Applications and Industry*, pp. 10–17. A criterion of transient performance developed previously and based on the time integral of absolute value of error is applied to second- and third-order linear servomechanisms with derivative- or integral-type error correction and different types of input.

621-526(083.71) **269**

The Terminology of Servo Systems.—P. Naslin. (*Onde élect.*, July 1954, Vol. 34, No. 328, pp. 588–593.) Definitions of fundamental concepts are given, which are to be submitted by the French Committee in the revision of the International Electrotechnical Vocabulary.

621.311.6 : 621.316.722 **270**

Regulated D.C. Supply has High Efficiency.—D. C. Bakeman & J. E. Richardson. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 165–167.) Description of 200-W unit using magnetic amplifiers for regulation in response to slow variations of line voltage or load and electronic clamping circuits for regulation in response to rapid variations.

621.316.721 **271**

Direct-Current Stabilizers for Electromagnets.—M. W. Jervis. (*Electronic Engng*, Oct. 1954, Vol. 26, No. 320, pp. 429–431.) General principles of operation and factors affecting stability are reviewed.

TELEVISION AND PHOTOTELEGRAPHY

621.397 **272**

A New Continuous-Feed Facsimile Scanner.—J. V. L. Hogan & G. M. Stamps. (*Elect. Engng, N.Y.*, July 1954, Vol. 73, No. 7, pp. 615–619.) The scanner comprises two rotating disks with spiral apertures in combination with a fixed linear slit. A photographic method of generating the spirals is outlined. The operation of the system in scanning wide copy is described; it has also been applied successfully in photo-recording on 35-mm film and in film scanning. For scanning bound copy the typewriter-style roller is replaced by a moving-frame mount.

621.397 **273**

Facsimile Scanning by Cathode-Ray Tube.—W. H. Bliss & C. J. Young. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 275–290.) Outlines are given of several experimental systems developed since the ultrafax system (1203 of 1949). It is more difficult to achieve scanning linearity with c.r.-tube scanning than with a rotating drum, especially at low speeds. The mechanical scanner also gives better definition than available c.r. tubes. For scanning flat-bed material, for high transmission speeds, or for systems using photographic reproduction, c.r.-tube methods may have advantages.

621.397.3 : 778.5 **274**

Film Scanning in Television.—R. Theile. (*Arch. elekt. Übertragung*, July 1954, Vol. 8, No. 7, pp. 305–317.) Various known methods are critically reviewed and compared. The discussion indicates that equipment using simple optical and mechanical arrangements only works with the more complicated television scanning methods, and vice versa. The two most important combinations in use are (*a*) flying-spot scanning with continuous film motion, one half of the vertical scanning being provided by the film motion, and (*b*) storage-tube scanning with intermittent film motion.

621.397.5 : 535.623 **275**

Colour Camera Convertor.—(*Wireless World*, Nov. 1954, Vol. 60, No. 11, p. 540.) A frame-sequential camera system is adapted for simultaneous transmission by passing the sequential colour signals from the camera to an electronic switching system which distributes the red signals to one c.r. tube, the blue signals to a second, and fractions of all three signals to a third. These three c.r. tubes are viewed by three pickup tubes, from whose output the simultaneous signals are derived. A brief account is given of a demonstration in which the frame-sequential camera was operated on 405 lines interlaced 2:1 with 150 frames/sec, the bandwidth being 9 Mc/s. The three pickup tubes were operated on 615 lines interlaced 2:1 with 50 frames/sec. Various display systems were used, including a tricolour tube and a three-tube projection unit.

621.397.5 : 535.623 **276**

Experimental Colour Television System using an Electrically Controlled Crystal [colour] **Filter.**—V. A. Babits. (*Ann. Télécommun.*, June 1954, Vol. 9, No. 6, pp. 187–190.) Report of preliminary tests carried out using an ADP-crystal colour filter in a projection system. Pulses of amplitude 8–10 kV and duration 1/144 sec were applied to the crystal in synchronism with the colour-sampling process in the transmitter. A block diagram of the complete system is given with details of the filter control circuit. With a single filter the colour saturation was about 55%. See also paper by Babits & Hicks in *Electronics*, Nov. 1950, Vol. 23, No. 11, pp. 112–115.

621.397.5(494) **277**

Experimental Television Service in Switzerland.—W. Gerber. (*Bull. schweiz. elektrotech. Ver.*, 24th July 1954, Vol. 45, No. 15, pp. 609–617.) A progress report on the stage of development reached at the end of 1953.

621.397.6 **278**

An Industrial Television Channel.—R. J. Boddy & C. D. Gardner. (*J. Telev. Soc.*, April/June 1954, Vol. 7, No. 6, pp. 248–261.) A detailed description is given of equipment providing broadcasting picture quality and comprising camera with Type-5907 c.p.s. emitron, control rack, and one or more monitoring receivers which are of standard type and fed with modulated r.f. from the rack output.

621.397.6 **279**

A Line Converter for the International Exchange of Television Programmes.—J. Haantjes & T. G. Schut. (*Philips tech. Rev.*, May 1954, Vol. 15, No. 11, pp. 297–306.) See 2469 of 1953.

621.397.61/.62 **280**

Factors in the Design of Keyed Clamping Circuits.—R. N. Rhodes. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 362–371.) Analysis is given for double-diode circuits for clamping the d.c. level in television.

621.397.61 **281**

Monochrome Vidicon Film Camera.—W. L. Hurford & R. J. Marian. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 372–388.)

621.397.61 : 535.623 **282**

Television Transmitter Considerations in Color Broadcasting.—T. M. Gluyas, Jr. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 312–334.) Large-area colour fidelity depends on the amplitude/frequency characteristic, linearity and differential phase response. Colour fidelity at area edges depends on amplitude/frequency characteristic and envelope delay. The signal is predistorted in auxiliary equipment to obtain good final linearity and prescribed envelope delay. Monitoring arrangements include a vestigial-sideband demodulator.

621.397.611 : 778.5 **283**

Continuous Scanner for Televising Film.—R. E. Graham. (*Bell Lab. Rec.*, July 1954, Vol. 32, No. 7, pp. 250–256.) A flying-spot scanner for standard 35-mm film, developed for research on television transmission, uses a mirror-drum arrangement in which the mirrors are individually as well as collectively rotated for optical compensation of the continuous film motion. The brightness of the scanning spot is controlled by means of a flicker-suppressing servo system operated by pulses derived from an 'over-scan' area of the c.r. tube face.

621.397.611.2 **284**

An Experimental Photoconductive Camera Tube for Television.—L. Heijne, P. Schagen & H. Bruining. (*Philips tech. Rev.*, July 1954, Vol. 16, No. 1, pp. 23–25.) Further details are given of a tube described previously (1935 of 1954). The sensitivity for illumination of colour temperature 2 600°K is 100–200 μA per lumen, and the spectral distribution of sensitivity is about the same as that of the transparent CsSb photoemission-type target. The response time of the experimental model is sufficiently short for most industrial purposes; it is hoped to reduce this time further to permit use of the tube for television broadcasting.

621.397.62 **285**

TV Receiver operates on Four System Standards.—W. Werner. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 140–143.) A receiver designed to operate on the C.C.I.R. 625-line and the French 819-line as well as the two Belgian standards is described. After providing adequate rejection of the sound, which is amplitude modulated in three of the systems, the available video bandwidth is 4·25 Mc/s. The same i.f. picture amplifier is used for all four systems, with a carrier frequency of 38·9 Mc/s. A separate i.f. sound amplifier is taken off directly after the tuner; the sound i.f. is converted to 7 Mc/s by means of a second oscillator. Switching arrangements between a.m. and f.m. sound and between negative and positive picture modulation are described. Amplified picture a.g.c. is provided.

621.397.62 : 535.623 **286**

The CT-100 Commercial Color-Television Receiver.—L. R. Kirkwood & A. J. Torre. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 445–460.) A receiver designed to operate on the F.C.C. compatible colour standards approved in December 1953 uses 37 receiving valves, two Se rectifiers, one Si diode and two Ge diodes as well as a Type 15GP22 three-gun colour kinescope. A detailed description including complete circuit diagrams is given.

621.397.62 + 621.396.62].002.2 **287**

Dip-Soldered Chassis Production.—Cass & Hadfield. (See 255.)

621.397.621.2 : 535.623 : 621.385.832 **288**

Beam-Deflection Color-Television Picture Tubes.—J. M. Lafferty. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1478–1495.) Detailed analysis is presented for tubes of the type in which an e.s. field is produced between the phosphor screen and a parallel perforated screen, and the beam is directed obliquely into this field. The beam direction within the field is controlled by means of colour-signal voltages applied to one of the electrodes, so that the beam strikes either the front of the phosphor screen ('transmission' case, accelerating field) or the back of the perforated screen ('reflection' case, retarding field) at a spot coated with phosphor of corresponding colour. A reflection-type tube was described by Weimer & Rynn (846 of 1952). Advantages of both types are automatic colour registry, simple monochrome presentation, short tube length, low colour-switching-electrode capacitance and equal numbers of the three colour elements. Techniques used in the construction of 16-in. and 24-in. reflection-type tubes, and methods of preparing the colour screens are described.

621.397.621.2 : 537.533.8 **289**

Secondary Emission from the Screen of a Picture-Tube.—J. de Gier, A. C. Kleisma & J. Peper. (*Philips tech. Rev.*, July 1954, Vol. 16, No. 1, pp. 26–32.) Methods of measuring the secondary-emission factor δ and the potential of the fluorescent screen under operating conditions are discussed. Negative charging of the screen when δ is less than or not much greater than unity may give rise to ion burn. A suitable value of δ is obtained by applying a very thin film of MgO to the screen.

621.397.82 **290**

Interference to Color and Monochrome Television Receivers by Oscillator Radiation and other C.W. Signals.—E. W. Chapin, W. K. Roberts & L. C. Middlekamp. (*Trans. Inst. Radio Engrs*, July 1954, No. PGBTR-7, pp. 47–58.) The concept and measurement of the 'beat size' effect are discussed, the term 'beat' being used to indicate a sequence of areas having brightness values alternately greater and less than that properly associated with the picture. The size of these areas depends on the frequency separation between the interfering signal and the picture carrier; for a monochrome picture the interference level that can be tolerated is 25–30 db greater if it falls in the upper part of the channel than if it falls near the picture carrier. With colour television additional suppression of oscillator radiation may be necessary since, because of the greater degree of occupancy of the channel by the desired signal, it is not possible to derive much advantage from this beat size effect.

TRANSMISSION

621.396.61 **291**

S.W. Transmitter Pre-amplifier and Driver Stages.— E. Kettel. (*Telefunken Ztg*, July 1954, Vol. 27, No. 104, pp. 114–123.) Two transmitters are considered. The first is a s.s.b. telephony transmitter with built-in monitor, accommodating four telephony channels. The second is a telegraphy transmitter for A1, A2 and F1 working, with provision for A3 and F4 working as required. Special filter arrangements limit the bandwidth transmitted.

VALVES AND THERMIONICS

621.314.63 : 546.289 **292**

Barrier-Layer Capacitance of the Ge-In Alloyed Rectifier.—H. U. Harten, W. Koch, H. L. Rath & W. Schultz. (*Z. Phys.*, 22nd July 1954, Vol. 138, Nos. 3/4, pp. 336–344.) Report of an experimental investigation of the equation $1/C^2 = \alpha (U + U_0)$, where C is the capacitance, defined as the change of charge with change of blocking voltage U, and α is a function of the donor density. An approximate formula for U_0 is given; calculated values agree well with experimental results obtained both at temperatures in the range 100°–300°K with donor density $3{\cdot}2 \times 10^{14}$ cm^{-3} and at a temperature of 295°K with donor densities between 10^{14} and 10^{15} cm^{-3}. Applied blocking voltage was 0·3 V in both cases. The effect of the inversion layer on capacitance is explained by consideration of a simple barrier-layer model. See also 3069 of 1954 (Rath).

621.314.63 + 621.314.7](083.7)] : 537.311.33 **293**

I.R.E. Standards on Electron Devices: Definitions of Semiconductor Terms, 1954.—(*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. 42, No. 10, pp. 1505–1508.) Standard 54 I.R.E. 7S2.

621.314.632 : 621.396.822 **294**

Noise in Silicon Microwave Diodes.—G. R. Nicoll. (*Proc. Instn elect. Engrs*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 317–324.) Measurements made on point-contact diodes with d.c. bias current are discussed. Flicker noise may be greater than shot noise at measurement frequencies up to and probably appreciably above 45 Mc/s. Diodes with a low value of flicker noise show for small bias currents good agreement at 45 Mc/s with calculated values of shot noise. As the bias current is reduced the shot noise tends to the value expected for the thermal noise; thus the thermal noise, corresponding to zero bias, may be calculated using the shot-noise concept. Noise in the range 30–40 kMc/s produced by reverse bias may be ascribed entirely to shot noise. Mixer noise correlates fairly closely with d.c. bias noise; noisy mixer action is therefore due to a large component of flicker noise.

621.314.7 **295**

The Transistor: Part 1—General Introduction.—J. R. Tillman. (*P. O. elect. Engrs' J.*, July 1954, Vol. 47, Part 2, pp. 92–93.) A brief historical account of the development of the transistor, with an indication of possible applications in telecommunications.

621.314.7 **296**

The Transistor: Part 2—Outline of the Theory of Point-Contact and Junction Transistors.—F. F. Roberts. (*P.O. elect. Engrs' J.*, July 1954, Vol. 47, Part 2, pp. 94–96.) Transistor action is briefly explained in terms of the injection and collection of holes or electrons in excess of the equilibrium concentration.

621.314.7 : 621.317.3 **297**

The Measurement of the Small-Signal Characteristics of Transistors.—Cooke-Yarborough, Florida & Stephen. (See 195.)

621.314.7 : 621.317.733 **298**

A Bridge for measuring the A.C. Parameters of Point-Contact Transistors.—Boothroyd & Datta. (See 213.)

621.314.7 : 621.317.733 **299**

A Bridge for Measuring the A.C. Parameters of Junction Transistors.—Boothroyd & Almond. (See 214.)

621.314.7.012.8 **300**

Physical Theory of New Circuit Representation for Junction Transistors.—J. Zawels. (*J. appl. Phys.*, Aug. 1954, Vol. **25**, No. 8, pp. 976–981.) An equivalent circuit is derived which directly interprets the diffusion equation and the boundary conditions including the effects of base-width modulation. The active part of the circuit is found to be independent of frequency. A modified form particularly convenient for representing the transistor with common grounded emitter is discussed, and the parameters are evaluated from experimental results.

621.385 : 537.533.1 **301**

On Some Effects of Velocity Distribution in Electron Streams.—S. V. Yadavalli. (*Quart. appl. Math.*, July 1954, Vol. 12, No. 2, pp. 105–116.) The problem of the electron beam with rectangular distribution of electron velocities and small-signal modulation is solved by a Laplace-transform method using an integral equation based on the Liouville theorem. The results are consistent with those derived by Llewellyn & Peterson (**2578** of **1944**) for a uniform-velocity beam. The case of a beam with a narrow velocity spread in an accelerating field is considered briefly. See also **3412** of **1954**.

621.385 : 621.318.57 **302**

Development of Trochotrons.—J. Björkman & L. Lindberg. (*Ericsson Tech.*, 1954, Vol. 10, No. 1, pp. 3–105.) See **3079** of **1954**.

621.385 : 621.396.822 **303**

The Noise of Valves.—C. S. Bull. (*Brit. J. appl. Phys.*, July 1954, Vol. 5, No. 7, p. 270.) Correction to paper abstracted in **3080** of **1954**.

621.385 : 621.396.822 **304**

A Theorem concerning Noise in Electron Streams.—J. R. Pierce. (*J. appl. Phys.*, Aug. 1954, Vol. **25**, No. 8, pp. 931–933.) A formula is derived for the lower limit value of the product of the maximum and minimum values of noise current in a noise standing wave on an electron stream.

621.385.029.6 **305**

Positive-Ion Trapping in Electron Beams.—E. L. Ginzton & B. H. Wadia. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. **42**, No. 10, pp. 1548–1554.) A detailed study is made of the use of positively biased gridless electrodes near the cathode, in valves with drift spaces, to prevent positive ions from being collected by the cathode and thus to keep them available for neutralizing electron space charge. Experiments indicate that if the electron beam nearly fills the cross-section of the cylindrical electrode surrounding it, traps of this type are not so successful as when the beam diameter is small compared with the electrode diameter. In one case the electron beam current transmitted through the drift space was increased from 12% to 80% of the cathode current.

621.385.029.6 : 621.372.8 **306**

Measurement of Circuit Impedance of Periodically Loaded Structures by Frequency Perturbation.—E. J. Nalos. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. **42**, No. 10, pp. 1508–1511.) The impedance of the wave-retarding structure in a travelling-wave valve is determined by a method which has been used previously in the design of linear accelerators [**2595** of **1949** (Slater)] and which does not involve the electron beam. The structure is short-circuited at suitable planes of symmetry to make it resonant, and observations are made of the change of resonance wavelength as a function of the position of a perturbing body introduced into the field. Values predicted by this method for the gain of a valve with a disk-loaded structure are in agreement with measured values.

621.385.029.6.012.3 **307**

A Nomogram for Hartree's Threshold-Voltage Criterion for Magnetrons.—J. D. Harmer. (*Electronic Engng*, Oct. 1954, Vol. **26**, No. 320, p. 441.) "Hartree's threshold voltage criterion is used to predict the operating conditions or identify from test results the mode of operation of a cylindrical multi-resonator magnetron. A nomogram for this criterion is presented. It includes a scale giving the upper limit to the electronic efficiency of the magnetron."

621.385.832 **308**

Characteristics of a Transmission Control Viewing Storage Tube with Halftone Display.—M. Knoll, H. O. Hook & R. P. Stone. (*Proc. Inst. Radio Engrs*, Oct. 1954, Vol. **42**, No. 10, pp. 1496–1504.) Description of a tube of the general type described previously [**1975** of **1954** (Knoll et al.)] but modified in regard to various constructional features and including a separate erasing gun. Applications to radar, projection television, television-system conversion and oscillography are mentioned.

621.385.832 **309**

Method of Determining the Aberrations of a Magnetic-Deflection Unit.—G. Wendt. (*Ann. Radioélect.*, July 1954, Vol. 9, No. 37, pp. 286–307.) A specially designed c.r. tube has an extra long neck which accommodates (*a*) an electron gun producing a fine pencil beam, (*b*) a focusing coil, (*c*) a deflection coil rotating at about 1 r.p.s., (*d*) a second focusing coil, (*e*) the deflection coil under examination. Careful centring of all electrodes and coils is essential. For measurements of aberrations causing beam defocusing, the figures described on the screen as the current in the deflection coil under test is varied are photographed. Aberrations of various types can be distinguished, and their numerical values ascertained from tables provided. Distortions are measured from photographs of a grid of lines produced on the screen by the deflection coil under test.

MISCELLANEOUS

68 : 621.3 **310**

Mechanical Design of Electronic Equipment.—(*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. M1–M64.) A special supplement surveying latest production methods and materials.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.121.1 311

Excitation of Flexural Vibrations in Metallic Plates using Polycrystalline Barium Titanate.—I. S. Zheludev. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1467–1473.) Production of Chladni's figures with square Fe, Al and duralumin plates is described. The $BaTiO_3$ powder is fixed in a given pattern in an adhesive between the plate and appropriately shaped foil electrodes, and is then polarized. The observed frequencies of vibration are in good agreement with values calculated from the Ritz formula; frequencies between 450 c/s and 20·3 kc/s were produced.

534.213.4 312

A New Method of Computing Acoustical Filters.—W. K. R. Lippert. (*Acustica*, 1954, Vol. 4, No. 4, pp. 411–420.) Filters consisting of *n* equal sections, with non-reflecting output duct, are considered. Each section consists of an input and output duct of uniform cross-section with a discontinuity between them. For loss-free filters, the characteristic transmission and reflection factors may be expressed in terms of B and β, where the transmission factor for a single section is $T = Be^{j\beta}$. Graphs are drawn for the corresponding quantities for 2, 3 and 4 sections. Measured and computed values for a filter with two rectangular bends, i.e. with two sections, are in satisfactory agreement. The characteristic factors for a filter with a reflecting output duct or with dissimilar sections may be derived from the fundamental case.

534.232 : 538.652 313

Some Remarks on the Analysis of Magnetostrictive Transducers.—H. Nodtvedt. (*Acustica*, 1954, Vol. 4, No. 4, pp. 432–438.) From the energy conditions in the system, an expression for the coupling coefficient is derived and used in plotting a curve of coupling-coefficient/polarizing-field for a Ni rod. Equivalent circuits of the rod are considered, and the analysis of either the admittance or impedance diagrams is shown to give the transducer operational parameters.

534.24-14 314

Radiation Pressure in Fluids.—J. Mercier. (*Acustica*, 1954, Vol. 4, No. 4, pp. 441–446. In French.) Radiation pressure is treated as a vector quantity equal to the product of the excess pressure and the velocity of displacement of a section of a plane wave. In the case of reflection from an obstacle, it must be calculated separately for incident and reflected waves. The cases of plane waves in an absorbent medium and spherical waves are also considered.

534.833.4 315

Sound Transmission through Spherical Bosses.—A. Bergassoli, F. Canac & T. Vogel. (*Acustica*, 1954, Vol. 4, No. 4, pp. 403–405. In French.) The frequency response curves for sound transmitted through (*a*) a hollow spherical boss, and (*b*) a disk having the same base dimensions were obtained. One plexiglass and three Al bosses were used, with different radii of curvature and/or heights. Sound insulation is considerably improved at frequencies below 1 000 c/s by using a boss. Simple theory can account fairly well for these results.

534.844 316

The Acceptability of Artificial Echoes with Reverberant Speech and Music.—A. F. B. Nickson, R. W. Muncey & P. Dubout. (*Acustica*, 1954, Vol. 4, No. 4, pp. 447–450.) An artificial echo of adjustable intensity level and delay was added to speech and music signals. The subjectively determined acceptable-echo-level/delay relation is dependent on (*a*) the Haas effect (*Acustica*, 1951, Vol. 1, pp. 49–58) for delay times up to 50 ms, (*b*) natural echoes in the recording room for the next few hundred milliseconds, and (*c*) the dynamic range of the programme material for longer delay times.

534.86 317

Facilities for the Sound Recording and Observation of Interviews.—G. F. Mahl, J. Dollard & F. C. Redlich. (*Science*, 13th Aug. 1954, Vol. 120, No. 3111, pp. 235–239.) The special conditions to be considered in relation to the recording of psychotherapeutic interviews are discussed. An installation at Yale University comprises a suite of two interviewing rooms with individual control rooms, and a waiting room forming a sound lock. Details are given of the low-noise air-conditioning system. A diaphragm-blanket acoustic treatment renders the sound natural although the rooms are quiet.

621.395.623.7 **318**

Loudspeakers and Enclosures.—(*Audio*, Aug. 1954, Vol. 38, No. 8 pp. 27–28..55.) A comprehensive survey, in simple terms, of the construction and operation of modern loudspeakers, including baffles and combination systems.

621.395.623.743 **319**

Electrostatic Speaker accents High Frequencies.—M. Hobbs. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 143–145.) A loudspeaker for the range 7–15 kc/s comprises a stiff curved perforated copper-backed plate mounted rigidly with a gold-sprayed styroflex or polyethylene foil stretched over it; the capacitor thus constituted has a capacitance of about 4mμF. A polarizing voltage of the order of 250 V is required. The arrangement provides an economical design for radio receivers, used in conjunction with a cone loudspeaker for the lower frequencies.

621.395.625.3 **320**

New Portable Magnetic Recorder Type R85 for Commentaries.—K. E. Gondesen. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 5/6, pp. 127–132.) The electrically driven recorder, amplifier unit and batteries are combined in a suitcase model weighing about 10 kg. The tape runs at 19 cm/s and reverses mechanically. One amplifier deals with recording and erasing, a separate one with reproduction and modulation control. A spool runs for 30 min, and the accumulator which drives the motor permits continuous operation for four hours.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.372.51 : 621.396.67 **321**

New Antenna Coupler for U.H.F. Circuits.—R. I. Stainbrook. (*Tele-Tech*, Aug. 1954, Vol. 13, No. 8, pp. 86–88..181.) Coupling units for the 230–390-Mc/s frequency band comprising cut-away coaxial-line sections are described. These couplers, when arranged in groups of 2–6 units, provide a system in which 2–6 transmitters, receivers and/or transmitter-receivers can operate simultaneously on a single aerial. The insertion loss for each one of a 6-unit group is 0·66 db.

621.372.2 + 621.372.8 **322**

The Transformation Properties of Lossless Six-Terminal Networks between Homogeneous Transmission Lines, their Representation by a Six-Terminal-Network Surface and their Significance in Measurement Technique.—H. Lueg. (*Arch. elekt. Übertragung*, Aug. 1954, Vol. 8, No. 8, pp. 331–340.) The transfer characteristics of a six-terminal network representing a waveguide junction are derived by a matrix treatment and a three-dimensional surface is constructed, projection of which on to an appropriate plane gives the position of a voltage node on the input line as a function of the location of short circuits on the other two lines. Using the double-short-circuit technique [2850 of 1954 (Weissfloch)] input impedance can be determined directly by plotting a single curve. Power distribution between the outputs is dealt with and a method of determining parameter values for the equivalent circuits is illustrated.

621.372.2 **323**

The "Unit" Treatment of Impedance Irregularities and its Application to Long Lines.—A. Rosen. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 271–289. Digest, *ibid.*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 349–356.) Line irregularities are studied by a statistical method alternative to that based on correlation theory. It is assumed that the irregularities are built up of units each of which has a characteristic form; this may be produced by one independent physical factor operating over its own characteristic distance, but the amplitudes of the resulting unit irregularities occurring at different places along the line may be different, each being independent of any other. The length of the unit irregularity is assumed to be small compared with the length of the line, so that the attenuation over this length can be neglected. The procedure is to assemble a family of lines in which the amplitudes of the units are distributed at random and in which the units can occupy all positions with equal probability; the mean and mean-square values of the reflection and transmitted-echo coefficients for this family are calculated. The method is used to examine the effects of line irregularities on wide-band telephony and television transmissions. Results indicate that while the smoothness of the input-impedance/frequency characteristic is a suitable criterion for the regularity of coaxial-cable sections for telephony, this should be supplemented by pulse-reflection observations if the cable is intended for television. See also 1295 and 1668 of 1954.

621.372.2 **324**

Lower Modes of a Concentric Line having a Helical Inner Conductor.—L. Stark. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1155–1162.) Analysis is presented using cylindrical coordinates, the helix being assumed for convenience to have the form of an infinitely thin tape. Closed expressions are derived for the propagation factors of some of the lower modes. Numerical results are presented for a system with typical geometry.

621.372.2 **325**

Directional Electromagnetic Couplers.—B. M. Oliver. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1686–1692.) General theory is given for the directional coupling action of ordinary transmission lines. Simple transmission-line couplers for the 1-Mc/s–1-kMc/s band are discussed; the transmission characteristic is controlled by varying the coupling along the lines. An arrangement of four wires, or two wires and ground, is described which can serve simultaneously as directional coupler, filter and transformer.

621.372.2 + 538.566] : 621.3.012 **326**

New Chart for the Solution of Transmission-Line and Polarization Problems.—G. A. Deschamps. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, p. 188.) Addendum to 965 of 1954, acknowledging earlier work by Steiner (1361 of 1947).

621.372.2.029.6 **327**

Contribution on the Physics of the Multilayer Transmission Line.—W. Wild, H. Larsen & W. Eberl. (*Arch. elekt. Übertragung*, Aug. 1954, Vol. 8, No. 8, pp. 346–352.) A laminated coaxial line with five conducting layers is treated as four elementary pairs each of which is coupled to its neighbours by the impedance of the common conducting lamina. Taking account of this coupling, and assuming a uniform propagation coefficient, analysis shows that (*a*) resistive losses are low, since each conductor carries only the difference of the transmission currents of two adjacent pairs; (*b*) towards the centre of the stack of laminae these transmission currents increase steadily while the conductor currents tend to zero. This result is generalized to apply to any number of layers; the coupling impedance greatly affects the magnitude and frequency characteristic of the line attenuation. Methods of coupling a laminated line to a two-wire system are briefly considered.

621.372.2.029.6 **328**

Input and Output Couplings for Coaxial Laminated Transmission Lines.—H. Kaden & H. E. Martin. (*Arch. elekt. Übertragung*, Sept. 1954, Vol. 8, No. 9, pp. 387–403.) An examination is made of the energy loss due to mode conversion when a laminated line is excited by coupling it to a coaxial line. For a laminated line without metal core this loss is reduced to a minimum value of 0·064 N by making the radius of the inner conductor of the coaxial line 26·8% and the inner radius of the outer conductor of the coaxial line 91·7% of the radius of the laminated line. For a laminated line with metal core and radius ratio 3·65 the corresponding values are 0·0503 N, 39·8% and 92·7%. If in addition losses due to reflections at the junctions are eliminated by inserting transforming sections, total coupling loss at sending and receiving ends can be reduced to 0·128 N and 0·106 N respectively. The mode conversion losses can be further reduced by applying different potentials to the laminations; the design of networks for supplying these potentials is discussed.

621.372.8 **329**

Reciprocity Theorem applied to Waveguide Junctions with Elliptical Polarization.—G. Pircher. (*C. R. Acad. Sci., Paris*, 20th Sept. 1954, Vol. 239, No. 12, pp. 694–696.) Matrix analysis is presented based on consideration of the combined effects, at a reference plane in each waveguide arm, of the waves travelling towards and reflected from the junction, each of which can be represented either by a pair of orthogonal linearly polarized components, or by a pair of components with opposite directions of rotation.

621.372.8 **330**

An Estimation of the Discontinuities introduced by Flange Couplings in Rectangular Waveguides.—R. B. Nicholls. (*Elliott J.*, Aug. 1954, Vol. 2, No. 1, pp. 140–143.) From measurements made with couplings displaced abnormally sideways and with relatively large gaps left between flanges, theoretical predictions can be checked and the effects of smaller discontinuities estimated. Transverse displacements and twists occurring in flanged guides made to present dimensional tolerances are found to be of minor significance, but even small gaps (e.g. 0·001 in. at 3 cm λ) may give rise to serious reflections.

621.372.8 **331**

Propagation of Electromagnetic Waves over Plane Surface with Anisotropic Homogeneous Boundary Conditions.—M. A. Miller. (*C. R. Acad. Sci. U.R.S.S.*, 1st Dec. 1952, Vol. 87, No. 4, pp. 571–574. In Russian.) The surfaces considered are corrugated waveguides consisting of an assembly of thin parallel metal strips mounted on a metal base with or without guiding walls, as described by Rotman (33 of 1952). The dependence of the propagation modes on the ratio of surface reactance components is discussed.

621.372.8: 621.318.134 **332**

Propagation of Transverse Electric (TE) Waves in a Waveguide containing Ferrites.—A. Chevalier & E. Polacco. (*C. R. Acad. Sci., Paris*, 20th Sept. 1954, Vol. 239, No. 12, pp. 692–693.) Analysis is presented for the TE_{m0} mode propagated in a rectangular waveguide with an applied magnetic field perpendicular to the direction of propagation and parallel to the guide thickness.

621.396.67: 621.372.8 **333**

Application of Homogeneous Boundary Conditions in the Theory of Thin Aerials.—M. A. Miller. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1483–1495.) Theory of thin aerials and of slot radiators is applied to the case of aerials with given homogeneous anisotropic boundary conditions of the type $E_z = Z_1 H_\tau|_\Sigma$, $E_\tau = -Z_2 H_z|_\Sigma$, where Z_1 and Z_2 are different complex impedances which can be considered as components of the tensor of surface impedance Z; z and τ are orthogonal coordinates on the surface of the aerial Σ. Such boundary conditions can be formulated for the interface of two media if the structure of the field in one medium is known and is independent of the structure of the field in the other medium (331 above). The formulae derived are applied to the case of a disk-loaded cylindrical waveguide section, the dimensions of the disks being small compared with λ, and to a rectangular corrugated waveguide element in the form of a short trench.

621.396.673 **34**

The Characteristics of a Vertical Antenna with a Radial Conductor Ground System.—J. R. Wait & W. A. Pope. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 177–195.) An approximate method is presented for calculating the input impedance; graphical methods are used in evaluating integrals involved in the solution. Results are plotted to show the dependence of the impedance on the number and length of the radial conductors for given frequency, aerial height and ground conductivity. The presence of the ground system modifies the radiated fields by only a few parts in a hundred under usual conditions. Calculated values for a 250-ft mast are in good agreement with experimental results for operation at 100 kc/s.

621.396.676: 621.396.93 **335**

Ultra-High-Frequency Omnidirectional Antenna Systems for Large Aircraft.—W. Sichak & J. J. Nail. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 202–213.) Reprint. See 2568 of 1954.

621.396.677 **336**

On the Optimum Illumination Taper for the Objective of a Microwave Aerial.—J. W. Crompton. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 371–382.) "The Fourier-transform description of the radiation pattern from an aperture is used to obtain curves relating the overall gain of an idealized aerial system, comprising an objective and waveguide flare, with the size and illumination of the aperture of the latter. For rectangular objectives the dimensions of the aperture of the flare may be varied independently in the two planes of symmetry and the overall gain obtained by multiplying together the gain factors for the distributions across the objective in these two planes. In the case of the circular objective this no longer applies, but curves are drawn showing the variation of the gain of the system as the size of a symmetrical feed is varied by equal amounts in the two planes of symmetry. It is shown that maximum overall gain is obtained with a rectangular objective when the size of the feed is adjusted to give a primary pattern such that the illumination intensity at the edges of the objective is 8½ dB below that at the centre. The corresponding optimum taper for circular objectives is 11½ dB. Primary radiation-patterns are drawn for 'constant', 'cosine' and 'double-cosine' illuminations of the feed aperture. The variations of secondary beam-widths and first side-lobe levels with feed size for rectangular and circular objectives are discussed."

621.396.677.32 **337**

Resonance in a System of Coupled Vibrators and Tuning of 'Wave-Channel' Aerials.—D. M. Vysokovski. (*C. R. Acad. Sci. U.R.S.S.*, 1st Aug. 1954, Vol. 97, No. 4, pp. 659–662. In Russian.) The calculation of the mean length of the director elements of this Yagi-type aerial to give maximum directivity is considered for the case of weak coupling between the elements, which are spaced at $\lambda/3$. The useful range of element lengths is from about $0{\cdot}46\ \lambda$, which is optimum for one director, to about $0{\cdot}41\ \lambda$, which is optimum for 20.

621.396.677.71.012.12 **338**

Polar Diagrams of Plane Slot Aerials.—G. N. Kotschershewski. (*NachrTech.*, June 1954, Vol. 4, No. 6, pp. 272–274.) A vertical $\lambda/2$ slot in a plane screen with dimensions of the order of one wavelength is considered as a magnetic dipole and an approximate expression is derived for the current density distribution in the horizontal plane. Polar diagrams are constructed for the equatorial horizontal plane for radiation (*a*) on one side only and (*b*) on both sides of the slot; these agree closely with experimental results.

621.396.677.833.2: 535.42: 538.566 **339**

On the Radiation Pattern of a Paraboloid of Revolution.—J. P. Schouten & B. J. Beukelman. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 137–150.) The pattern is determined using the form of Huyghens' principle in which the field intensities in a given domain are expressed in terms of their tangential components on the boundary. Expressions involving infinite series of Bessel functions are obtained for the intensities of the distant field when an electric dipole is placed at the focus.

AUTOMATIC COMPUTERS

681.142 **340**

A New German Differential Analyser for Differential Equations.—A. Walther. (*Z. Ver. dtsch. Ing.*, 1st Aug. 1954, Vol. 96, No. 22, pp. 755–758.) A mechanical instrument built for the Institute of Applied Mathematics, University of Bonn, and comprising eight integrators.

681.142 **341**

A Curve Analyzer and General-Purpose Graphical Computer.—C. S. French, G. H. Towner, D. R. Bellis, R. M. Cook, W. R. Fair & W. W. Holt. (*Rev. sci. Instrum.*, Aug. 1954, Vol. 25, No. 8, pp. 765–775.) The analogue computer described comprises five photoelectric curve followers, two integrators, nine adding amplifiers and a pen recorder. The independent variable is represented by a low alternating voltage increasing linearly with time; the form of the equation is determined by the connections between the units, and the values of constants are set by potentiometers.

681.142 **342**

Harmonic Cancellation from Computing Voltage Source in Servo Analogue Computers.—J. Alman. (*Elect. Engng, N.Y.*, Aug. 1954, Vol. 73, No. 8, pp. 711–713.) Analysis showing how harmonics of the carrier can be cancelled out in the summing network of the servo amplifier by injecting appropriate harmonic signals into the quadrature rejection circuit. The analysis is valid for very small phase shift. The system is advantageous when harmonics cannot be sufficiently attenuated by filters.

681.142 **343**

Some Comparisons between Analogue and Digital Computers.—W. E. Scott & A. C. D. Haley. (*J. Brit. Instn Radio Engrs*, Oct. 1954, Vol. 14, No. 10, pp. 476–486.) The uses of analogue and digital computers in industry are discussed and a large-scale machine of each class is described briefly.

681.142 **344**

Electronic Computers and Industrial Mathematics.—B. D. Dagnall & R. L. Michaelson. (*J. Brit. Instn Radio Engrs*, Oct. 1954, Vol. 14, No. 10, pp. 487–496.) The mode of operation of a high-speed digital computer is described in functional terms; programming procedure is illustrated in relation to typical applications.

681.142 **345**

The Application of Electronic Digital Calculating Methods to Punched Card Machines.—J. H. Lucas. (*J. Brit. Instn Radio Engrs*, Oct. 1954, Vol. 14, No. 10, pp. 497–503.) Principles of operation and design of the 'Electronic Multiplying Punch' are discussed. An outline is given of the calculating process used for sterling and for decimal systems.

681.142: 621.314.63 **346**

Welded Joints on Diodes reduce Computer Bulk.—S. G. Lutz. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 154–158.) Diode-mounting methods are discussed taking up the least possible space while affording adequate accessibility. By using spot welding, the diode leads can be shortened to $< \frac{1}{4}$ in. An elongated matrix and a honeycomb arrangement accommodating up to 128 diodes/in^3. are among the alternatives described.

681.142: 621.385.012 **347**

Making Use of Curved Characteristics for the Higher Types of Calculation in Electronic Computers.—H. Harmuth. (*Acta phys. austriaca*, July 1954, Vol. 8, No. 4, pp. 332–337.) Where errors up to a few per cent are permissible, deliberate use can be made of the curvature of valve characteristics in analogue computers. Circuits for multiplying, dividing, squaring and obtaining square roots are discussed.

681.142: 621.385.832 **348**

The Design of an Electrodynamic Multiplier.—E. M. Deeley. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 187–191. Digest, *ibid.*, Part II, June 1954, Vol. 101, No. 81, pp. 344–345.) Development of a design described earlier [1977 of 1949 (Deeley & Mackay)] for use in a differential analyser.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3: 621.316.5 **349**

The Suppression of Switching Transients by a Shunt *RC* Circuit.—E. A. Finlay. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 266–270. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 575–576.) A detailed analysis is presented of the phenomena occurring when apparatus including shunt capacitance is suddenly switched across a low-impedance source of power through a short transmission line; conditions for the transient voltage in the shunt *RC* damping circuit to be nonoscillatory are deduced. It is proved that the current through the switch can be made unidirectional. Numerical illustrations are given.

621.3.018.75: 621.387.4 **350**

Fast Single-Channel Pulse Amplitude Analyser.—W. L. Buys. (*J. Phys. Radium*, July/Sept. 1954, Vol. 15, Nos. 7/9, p. 582.) Designed for use with proportional or scintillation counters, the equipment has a channel-edge position stable to within ± 0·02 V under operation for periods up to 10 hours.

621.3.018.75: 621.387.4 **351**

Description of a Recording Instrument.—P. Desneiges & A. Pages. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 700–704.) The recorder was designed for operation with the pulse analyser described by Guillon (39 of January). It has 25 channels each comprising a decade counter and e.m. register; one unit is recorded in the *n*th channel for every train of *n* pulses. Details are given of circuits and operation.

621.3.066.6 **352**

Migration of Material in Silver and Platinum Contacts.—E. Holm & R. Holm. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, pp. 352–361.) An experimental investigation of deformation caused exclusively by the passage of current.

621.314.2 **353**

Component Design Trends — Iron-Core Transformers run Smaller and Hotter.—F. Rockett. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 136–142.) A survey of the developments in core materials, coatings and insulating materials and of new construction methods which have in combination made possible a 50% reduction of size of iron-core components over a period of about ten years while permitting operation at much higher temperatures.

621.314.7: [621.373.5 + 621.375.4 **354**

Surface-Barrier-Transistor Measurements and Applications.—R. J. Turner. (*Tele-Tech*, Aug. 1954, Vol. 13, No. 8, pp. 78–80..165.) Circuits for determining the transistor characteristics are described and examples of applications taking advantage of the high frequency cut-off of the surface-barrier transistor are given. These include a two-stage video amplifier of bandwidth 3·2 Mc/s and gain 28 db, a band pass amplifier for 5–55 Mc/s with measured power gain of 12·2 db at 55 Mc/s, a crystal-controlled oscillator delivering 400 μW at 50 Mc/s with an efficiency of 25%, a mixer with a conversion gain, from 55 Mc/s to 5 Mc/s, of 8·6 db, and a non-saturating flip-flop circuit with rise time 0·07 μs and fall time 0·15 μs.

621.316.8: [621.317.353 + 621.396.822 **355**

New Resistor Voltage-Coefficient Tester.—L. A. Rosenthal & A. S. Louis. (*Tele-Tech*, Sept. 1954, Vol. 13, No. 9, pp. 62–64..114.) The variation of resistance with applied voltage is determined from measurements of the third harmonic generated by the resistor on application of a sinusoidal voltage. The basic circuit is described and some experimental results are given. The measurements of resistor noise at a.f. is also briefly described.

621.316.8.029.5 **356**

The Design of a Radio-Frequency Coaxial Resistor.—C. T. Kohn. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, p. 299.) Discussion on 2019 of 1954.

621.316.84: 621.372.221 **357**

On the Use of Commercial Wire-Wound Resistors in High-Level Video Amplifiers.—A. J. Seyler. (*Proc. Instn Radio Engrs, Aust.*, Sept. 1954, Vol. 15, No. 9, pp. 219–227.) By compensating the inherent inductance by means of a parallel *RC* network, commercial wire-wound resistors can be adapted for use in high-power video amplifiers. Practical arrangements are illustrated and results of measurements are compared with calculated values.

621.316.86 + 621.316.89]: 621.396.822 **358**

Measurements on Current Noise in Carbon Resistors and in Thermistors.—K. M. van Vliet, C. J. van Leeuwen, J. Blok & C. Ris. (*Physica*, Aug. 1954, Vol. 20, No. 8, pp. 481–496.) Measurements are reported on carbon and similar resistors in the frequency range from 2 c/s to 1·2 Mc/s, and on negative-temperature-coefficient thermistors between 2 c/s and 50 kc/s. In carbon resistors the current noise is proportional to the square of the current (i) and inversely proportional to approximately the first power of frequency (ν). In thermistors the noise level is lower and the spectrum shows deviations from the $1/\nu$ relation. The spectral density in the part of the spectrum where the $1/\nu$ relation holds is proportional to $i^{1.2}$. This is in agreement with measurements by Brophy (*J. appl. Phys.*, Feb. 1954, Vol. 25, No. 2, pp. 222–224).

621.318.42 **359**

Calculation of Iron-Cored Inductances for Direct Current.—P. Ross. (*Rev. gén. Élect.*, Sept. 1954, Vol. 63, No. 9, pp. 551–559.) A method described by Kammerloher (29 of 1949) is used. The position of the maximum is determined corresponding to the optimum gap length for laminations of given shape and size; variation of the maximum with number of ampere-turns is investigated. Examples are worked out.

621.319.46 **360**

A Fixed Gas-Dielectric Capacitor of High Stability.—W. K. Clothier. (*Proc. Instn elect. Engrs*, Part II, Aug. 1954, Vol. 101, No. 82, pp. 453–459.) Factors contributing to instability of capacitors are reviewed and design principles are proposed for parallel-plate types suitable for use under laboratory conditions. A 1 000-μμF capacitor embodying these principles is described; the performance figures indicate that a considerable gain in stability can be achieved without serious complication in design.

621.37/.39.029.4: 004.1 **361**

Better Audio Specs Needed.—N. Grossman. (*Audio*, Sept. 1954, Vol. 38, No. 9, pp. 36, 38.) The significance is explained of technical terms commonly used in catalogue descriptions of a.f. amplifiers, loudspeakers and a.f. output transformers and a list is given of additional information required for a full technical description of components and apparatus.

621.37/.39].029.63/.64 **362**

Microstrip Kit.—(*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, p. 214.) Note of a commercially available set of microstrip components permitting rapid construction of circuits for operation in the frequency range 1–8 kMc/s.

621.372 **363**

A Mathematical Technique for the Analysis of Linear Systems.—J. R. Ragazzini & A. R. Bergen. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1645–1651.) The technique of the z transformation developed for investigating sampled-data systems [1801 of 1953 (Ragazzini & Zadeh)] is applied to the numerical solution of continuous linear systems. A model of the linear system is devised in which sampling is introduced at some convenient point. A polygonal approximation to the sampled function is reconstructed by means of a holding operator, and the output of the system is computed as a train of pulses.

621.372 **364**

Properties of some Wide-Band Phase-Splitting Networks.—M. Dishal. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, p. 1698.) Errors in the design equations presented by Luck (1614 of 1949) are indicated and alternative methods of deriving the design parameters are mentioned.

621.372 **365**

The Return-Difference Matrix in Linear Networks.—L. Tasny-Tschiassny. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 299–300.) Discussion on 662 of 1954.

621.372 **366**

The Solution of a Certain Differential Equation.—E. B. Moullin. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 290–299. Digest, *ibid.*, Part I, July 1954, Vol. 101, No. 130, pp. 204–206.) A method of obtaining approximate solutions to a class of nonlinear network problems is discussed. The method was developed in relation to the problem of a capacitor in series with a nonlinear resistor of the SiC type, and its application is illustrated by reference to this problem, the resistor characteristic being assumed cubic and the applied voltage simple harmonic. An exact steady-state solution for this network is unobtainable, but an approximate solution is obtained by choosing the constants in the formula for the voltage across the resistor such that the applied voltage has no third-harmonic component.

621.372: 512.831 **367**

Matrix Analysis of Linear Time-Varying Circuits.—L. A. Pipes. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1179–1185.)

621.372.413 **368**

On Cavity Resonators with Nonhomogeneous Media.—A. Cunliffe, R. N. Gould & K. D. Hall. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 215–218. Digest, *ibid.*, Part III, May 1954, Vol. 101, No. 71, pp. 192–193.) "Perturbation theory is used to find the frequencies of oscillation and Q-factors of a cavity containing a medium for which the permittivity and the permeability are arbitrary functions of position. The theory is applied to an H_{011} cylindrical cavity containing a disc of dielectric which does not extend over the complete cross-section of the cavity."

621.372.413: 530.145 **369**

Quantum Effects in the Interaction between Electrons and High-Frequency Fields: Part 1.—I. R. Senitzky. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 904–911.) The problem of determining at what frequency quantum-mechanical effects become apparent is approached by analysing the velocities of electrons after passage through a cavity resonator. From the formulae derived a calculation is made of the ratio of (minimum possible mean-square deviation of velocity) to (velocity increment due to the field). Assuming the volume of the cavity to be of the same order as λ^3 and the initial electron velocity to be one tenth that of light, this ratio becomes unity for a frequency of the order of 3×10^{12} c/s.

621.372.5 **370**

Synthesis of Ladder Networks to give Butterworth or Chebȳshev Response in the Pass Band.—E. Green. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 192–203. Digest, *ibid.*, Part III, March 1954, Vol. 101, No. 70, pp. 115–118.) General formulae are derived for the design of low-pass ladder networks. See also 1267 of 1953.

621.372.5 **371**

Synthesis of Constant-Time-Delay Ladder Networks using Bessel Polynomials.—L. Storch. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1666–1675.) A low-pass minimum-phase transfer function is constructed which produces a maximally flat time-delay/frequency characteristic and a nearly Gaussian impulse response. Evaluation of delay and loss characteristics is simplified since the transfer function can be expressed in terms of tabulated functions. Synthesis of the corresponding ladder network using low-Q elements is described. Characteristics of a class of related non-minimum-phase transfer functions are also discussed.

621.372.5 **372**

Gain-Bandwidth Limitations on Equalizers and Matching Networks.—H. J. Carlin. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1676–1685.) Comprehensive theory is presented and new results are given for the optimum voltage transfer to an arbitrary load.

621.372.5 **373**

Synthesis of Transfer Functions by Active *RC* Networks.—D. B. Armstrong & F. M. Reza. (*Trans. Inst. Radio Engrs*, June 1954, Vol. CT-1, No. 2, pp. 8–17.) A criterion is presented for determining whether a prescribed transfer function can be synthesized by means of an active *RC* network with a single feedback loop. It is shown that any quadratic function can be synthesized by this means; the arbitrary function can be treated by breaking it down into quadratic elements. Alternative methods involving (*a*) inversion of the transfer function or (*b*) a ladder-network realization are also discussed.

621.372.5 **374**

Power Gain in Feedback Amplifier.—S. J. Mason. (*Trans. Inst. Radio Engrs*, June 1954, Vol. CT-1, No. 2, pp. 20–25.) A search is made for a network figure of merit which remains invariant for different connection conditions; a quantity U is found satisfying this requirement and identified as the available power gain when the coupling is chosen to make the device unilateral. The quantity U may be useful for classifying active networks; its value is unity for a gyrator. The method directs interest to power gain and signal-flow considerations rather than to voltage gain and the network interpretation of an impedance matrix.

621.372.54 **375**

Determination of Energy and Phase Characteristics of Electrical Filters.—G. N. Rapoport. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1496–1498.) The Leontovich theorem, which states that in nondissipative media the velocity of propagation of e.m. energy is equal to the group velocity, is applied to the case of a filter, considered as an equivalent waveguide system. The velocity of propagation of energy can be calculated when the dispersion is known.

621.372.54.029.4: 534.113 **376**

Tunable Audio Filters.—G. Zelinger. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 173–175.) Electromechanical filters of clamped-resonant-reed type are described. The Q factor can be varied from 100 to 400 over the frequency range 60–700 c/s.

621.372.543.029.3 **377**

L.F. Vibration Filters.—F. M. Gol'tsman. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1350–1353.) The application of vibration galvanometers as l.f. narrow-band electrical filters is considered theoretically; experimental results for frequencies of 27–420 c/s are tabulated and presented graphically. The corresponding bandwidths varied between 0·6 and 3·8 c/s.

621.372.543.3: 621.372.22 **378**

Inhomogeneous Transmission Lines as Filters.—A. L. Feldstein. (*NachrTech.*, June 1954, Vol. 4, No. 6, pp. 264–266.) Mathematical treatment of the filtering action of a transmission line with periodic structure. Design is based on an approximate integral formula expressing reflection coefficient as a function of characteristic impedance ρ. Its application in a simple case shows that the centre frequency is determined by the length of a section, and the width of the stop band is dependent only on the total length, i.e. the number of sections. The formula gives results in good agreement with experiment for a single-section filter with ratio $\rho_{\max}/\rho_{\min} = 8$.

621.372.6 **379**

Improved Matrix and Determinant Methods for Solving Networks.—W. S. Percival. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 258–265. Digest, *ibid.*, Part III, July 1954, Vol. 101, No. 72, pp. 278–279.) "It is shown that a linear electrical network, which may include valves and transformers, can be represented topologically by a network composed entirely of elements of a single type. In its most general form an element of this type comprises four nodes and two directed branches. It is also shown that a linear electrical network can be represented algebraically by a matrix, termed an H-matrix. If the elements of the network are shown in the network diagram in the form of elements of the above type, the H-matrix can be written down directly from the network diagram."

621.373.4 **380**

Effect of Electrical Fluctuations on Valve Oscillator.—P. I. Kuznetsov, R. L. Stratonovich & V. I. Tikhonov. (*C. R. Acad. Sci. U.R.S.S.*, 1st Aug. 1954, Vol. 97, No. 4, pp. 639–642. In Russian.) The effect of fluctuations which are slow compared with the oscillation frequency is considered theoretically and a method of calculating the effect is developed based on the Einstein-Fokker equation.

621.373.4 : 621.376.3 **381**

Frequency Control of Short-Wave Oscillators by means of an Electrodeless Gas Discharge.—E. Häusler & B. Koch. (*Z. Naturf.*, Feb. 1954, Vol. 9a, No. 2, pp. 182–183.) Continuation of investigations reported previously [362 of 1954 (Koch)]. With lower oscillator power, higher gas pressure and looser feedback coupling a characteristic of quite different type is obtained, giving a rapid decrease of frequency with increase of anode voltage over a narrow range.

621.373.4 : 621.385.029.65 **382**

Possibility of obtaining Very Short Continuous Waves, using a Reflex Klystron supplying Energy at High-Order Harmonics of the Fundamental Oscillation.—J. Bernier & H. Leboutet. (*C. R. Acad. Sci., Paris*, 4th Oct. 1954, Vol. 239, No. 14, pp. 796–798.) A formula is given for determining the wavelengths of the natural resonances of the klystron cavity. The dependence of these wavelengths on the grid separation is shown graphically, together with curves giving the values corresponding to exact harmonics of the fundamental. The two families of curves intersect at an infinite number of points, at each of which the cavity is capable of oscillating at both fundamental and harmonic frequency. Using a klystron with a beam voltage of about 2 kV and current 65 mA, and reflector voltage 1–1·5 kV, wavelengths down to 1·7 mm (24th harmonic of 4·08 cm) have been generated with a power of some tens of microwatts.

621.373.431.1 **383**

Method for Elimination of Effect of Stray Capacitances in the Production and Amplification of Step Voltages.—W. Kroebel. (*Z. angew. Phys.*, July 1954, Vol. 6, No. 7, pp. 293–297.) Discussion is presented of the charge and discharge mechanism of a multivibrator circuit; to obtain a steep leading pulse flank, a rapid discharge of the negative charge accumulated at one of the anodes is necessary. This is achieved by using the anode-dynode path of an auxiliary secondary-emission valve. Pulses of amplitude up to 400 V, with flanks of slope about 10^{10} V/sec were obtained. Application of the principle in frequency dividers is also described.

621.375.1 **384**

General Properties of Electromagnetic Amplifiers.—D. A. Bell. (*Wireless Engr*, Dec. 1954, Vol. 31, No. 12, pp. 310–319.) The relations between gain, bandwidth or time constant, and power rating are discussed; results to be expected from use of feedback are examined. The amplifiers considered include thermionic-valve, magnetic and rotating-machine types. Devices for improving the shape of the pass-band normally involve delay; distributed amplifiers permit improvement of the gain-bandwidth parameter but not of the gain/time-constant ratio.

621.375.2.024 : 621.385.5 **385**

"Starved Amplifiers".—G. E. Kaufer. (*Electronic Engng*, Nov. 1954, Vol. 26, No. 321, pp. 498–503.) Advantages of the starved amplifier (i.e. valve operated with very low anode and screen voltages) for high-gain amplification of d.c. are indicated. Relevant valve data must be determined by the designer; typical curves for Type-6SG7 and 6AG5 miniature pentodes are presented and discussed.

621.375.221 **386**

Design of Video Couplings.—D. G. Sarma. (*Wireless Engr*, Dec. 1954, Vol. 31, No. 12, pp. 327–334.) A method is presented for designing low rise-time video-amplifier coupling networks with three of four independent elements by the proper location of complex zeros and poles of the network function. The relations between rise-time, overshoot and delay are determined. Graphs are presented for determining the type of response of a circuit with given constants, or the circuit constants for a given type of response.

621.375.222 **387**

Zero Stabilisation of Directly-Coupled Amplifiers.—E. H. Frost-Smith & A. R. B. Churcher. (*Elliott J.*, Aug. 1954, Vol. 2, No. 1, pp. 136–139.) Details are given of circuits in which stability of a direct-coupled amplifier is achieved by use of a second amplifier in a feedback arrangement. The auxiliary amplifier is highly stable but has a low cut-off frequency; hence low-frequency signals are pre-amplified, giving enhanced signal/noise ratio at these frequencies. For high-frequency signals the auxiliary amplifier is by-passed.

621.375.3 **388**

An Even-Harmonic Magnetic Amplifier.—P. D. Atkinson & A. V. Hemingway. (*Electronic Engng*, Nov. 1954, Vol. 26, No. 321, pp. 482–485.) The circuit is an adaptation of the inverter described by Frost-Smith (73 of 1954); a typical figure for the power gain is 1 000, and for the output 1 mW. The zero drift is less than the shift produced by an input power of 10^{-11} W. The input impedance ranges up to about 3 kΩ, making it suitable for use with many types of transducer, but the poor response time restricts application to cases where the input varies slowly. Multistage amplifiers of this type are useful for control and measurement purposes.

621.375.3 **389**

Fast-Response Magnetic Amplifiers.—G. E. Hughes & H. A. Miller. (*Trans. Amer. Inst. elect. Engrs, Part I, Communication & Electronics*, March 1954, Vol. 73, pp. 69–75. Digest, *Elect. Engng, N.Y.*, Aug. 1954, Vol. 73, No. 8, p. 723.) Expressions are given for the number of control turns and the gain of magnetic amplifiers of the type described by Ramey (3503 of 1953), in which load and control circuits operate on the magnetic state of the core on a time-sharing basis.

621.375.3: 538.244 **390**

Effect of Circular Field on Form of Longitudinal Magnetization Curve.—R. E. Ershov. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1508–1512.) The variation was investigated experimentally of the magnetization of an iron tube placed in a coaxial magnetic field combined with a circular field produced by a current flowing in a conductor placed along the axis of the tube. The results, which are presented graphically, are of interest in the construction of transformers for amplification of weak currents.

621.375.4 **391**

Feedback simplifies Transistor Amplifiers.—S. Schenkerman. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 129–131.) "Voltage amplification in transistor stages is obtained using a degenerative feedback path shunting the output and in series with the input. Use of interstage transformers or grounded-collector stages is avoided."

621.375.4.029.4 **392**

A Transistor Remote Amplifier.—P. Penfield, Jr. (*Audio*, Sept. 1954, Vol. 38, No. 9, pp. 26–27.) A portable a.f. pre-amplifier using Type-CK-721 point-contact transistors is described; precautions necessary to avoid damage to the transistors during construction of the equipment and during use are indicated.

621.375.5: 537.227 **393**

Ferroelectrics and the Dielectric Amplifier.—Mason & Wick. (See 447.)

621.375.9: 537.312.8 **394**

Galvanomagnetic Low-Frequency Amplifier.—E. Justi & H. J. Thuy. (*Z. Naturf.*, Feb. 1954, Vol. 9a, No. 2, pp. 183–184.) A simple arrangement is described based on the high magnetoresistance of Bi at low temperature. The device is much less noisy than an ordinary valve or transistor. See also 3179 of 1954 (Thuy).

621.376.239 **395**

Magnetic Demodulation with Sinusoidal Variation of the H.F. Induction Flux.—G. Meinshausen. (*Arch. elekt. Übertragung*, Sept. 1954, Vol. 8, No. 9, pp. 373–386.) With magnetic demodulation using sinusoidal r.f. current in the demodulating reactor [3400 of 1953 (Pungs & Meinshausen)], the r.f. flux is distorted. By arranging instead for the r.f. flux to be sinusoidal, the power can be increased. Analysis is given based on analogy with diode theory, the flux being treated as the equivalent of the voltage across the diode. Essential differences between magnetic and diode demodulators are discussed.

GENERAL PHYSICS

53: 519.2 **396**

Statistical Concepts in Theoretical Physics.—R. Fürth. (*Brit. J. appl. Phys.*, Aug. 1954, Vol. 5, No. 8, pp. 273–276.) A plea for the teaching of classical physics on an empirical basis on statistical lines, to make easier the transition to quantum physics.

530.112 **397**

Proposal for a New Aether Drift Experiment.—H. L. Furth. (*Nature, Lond.*, 11th Sept. 1954, Vol. 174, No. 4428, pp. 505–506.) Further elucidation of the proposal made previously (1726 of 1954).

535.23 **398**

The Maximum of the Planck Energy Spectrum.—R. N. Bracewell. (*Nature, Lond.*, 18th Sept. 1954, Vol. 174, No. 4429, pp. 563–564.) In the formula generally used for locating the maximum in the energy spectrum of a black body, the spectral distribution is based on the amount of energy lying between two closely spaced wavelengths. If the distribution is considered on a frequency basis instead of a wavelength basis, a very different value is obtained for the position of the maximum; for a body at 6 000° (roughly the temperature of the sun) the maximum then falls at 8 497 Å, which is outside the visible region. Re-examination of Planck's formula leads to a Wien-type law yielding a natural maximum at 6 115 Å for the 6 000° spectrum; the location of this maximum does not alter on changing from a wavelength to a frequency basis.

535.33: 538.56.029.6 **399**

Apparatus for Microwave Spectroscopy.—M. W. P. Strandberg, H. R. Johnson & J. R. Eshbach. (*Rev. sci. Instrum.*, Aug. 1954, Vol. 25, No. 8, pp. 776–792.) The design of a spectrograph using Stark modulation and a crystal or bolometer detector is discussed, and a detailed description is given of a particular equipment.

535.42 **400**

Diffraction of Waves by a Wedge.—F. Oberhettinger. (*Commun. pure appl. Math.*, Aug. 1954, Vol. 7, No. 3, pp. 551–563.) Green's functions of the wave equation for a wedge are given in the form of an integral representation for the two-dimensional case, and are evaluated by the residue theorem. The half-plane is considered as the limiting case of a wedge with angle 2π. The analysis is extended to the three-dimensional case.

535.42 **401**

A Uniqueness Theorem and a New Solution for Sommerfeld's and Other Diffraction Problems.—A. S. Peters & J. J. Stoker. (*Commun. pure appl. Math.*, Aug. 1954, Vol. 7, No. 3, pp. 565–585.)

535.42: 538.566 **402**

On the Scalar Diffraction by a Circular Aperture in an Infinite Plane Screen.—A. T. de Hoop. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 151–160.) Application of variational principles reduces the problem of finding the aperture distribution to the solution of an infinite system of linear equations. An investigation is made of a particular system of equations based on a convenient expansion of the aperture distribution given by Bouwkamp.

535.42: 538.566 **403**

General Approximation Method for solving Diffraction Problems.—M. Jessel. (*C. R. Acad. Sci., Paris*, 27th Sept. 1954, Vol. 239, No. 13, pp. 753–756.) A system of integro-differential equations is established for the boundary values. A known variational principle is used for calculating certain functionals involved.

537.291 + 538.691 **404**

Motion of Charged Particles in a Homogeneous Magnetic Field, with Superposed Magnetic Field of Linear Current and Electric Field of Cylindrical Capacitor.—V. M. Kel'man & S. Ya. Yavor. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1329–1332.) The problem considered theoretically by Kel'man & Rodnikova

(75 of 1953) is extended to include the effect of a magnetic field parallel to the axis of the cylinder. Calculated results for several particular cases are presented graphically.

537.311.31 : 621.317.332.029.65 **405**

R.F. Conductivity in Copper at 8 mm Wavelengths.—J. S. Thorp. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 357–359.) Measurements at 8 mm λ indicate that reduction of conductivity below the d.c. value is caused not only by surface roughness but also by the presence of surface layers having d.c. conductivity lower than that of the bulk material, and by stress in the bulk material. These effects can be overcome by etching and annealing, or by covering the surface layers by a process involving oxidation and reduction.

537.311.33 : 537.323 **406**

Limits of Practical Application of Pisarenko's Formula.—T. A. Kontorova. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1291–1297.) Pisarenko's formula expresses thermoelectric power in terms of charge-carrier concentration and effective mass and of absolute temperature. A constant factor is included to take account of scattering of the charge carriers in the crystal; its value depends on the type of scattering and crystal lattice. Calculations show that the errors are small ($<5\%$) up to carrier concentrations of about 2×10^{19} in atomic-lattice and $7{\cdot}2 \times 10^{19}$ in ionic-lattice crystals at 300°K. The errors are discussed, and compared with those of other formulae. Results are tabulated.

537.36 **407**

The Motion of Electricity.—J. J. Gruetzmacher. (*Naturwissenschaften*, Aug. 1954, Vol. 41, No. 16, p. 368.) Preliminary experiments are described on the mechanical transportation of electric charge, e.g. by blowing streams of ionized air, or by causing such streams to flow in tubes under a pressure difference. G-M tubes are used as detectors, with loudspeaker indicators. Currents up to 10^{-14} A have been produced.

537.525 : 546.291 **408**

Energy Distribution Function of Electrons in Pure Helium.—F. H. Reder & S. C. Brown. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 885–889.)

537.525 : 546.291 **409**

Microwave Determination of the Probability of Collision of Electrons in Helium.—L. Gould & S. C. Brown. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 897–903.)

537.525.72 : 538.63 **410**

Some Effects in Inductively Coupled Electrodeless High-Frequency Gas Discharges with Superposed Magnetic Field.—H. Neuert, H. J. Stuckenberg & H. P. Weidner. (*Z. angew. Phys.*, July 1954, Vol. 6, No. 7, pp. 303–310.) The effects noted by Lindberg et al. (85 of 1953) were further investigated. The resonance effect appears to be due to electrons moving initially in circular orbits coaxial with the tube wall rapidly acquiring energy in the alternating field. An application of the effect in a h.f. ion source is briefly described. For another application see 90 of 1954 (Koch & Neuert).

538.221 **411**

Extension of the Spin-Wave Theory of Ferromagnetism to Higher Temperatures.—G. Heber. (*Z. Naturf.*, Feb. 1954, Vol. 9a, No. 2, pp. 91–97.)

538.3 **412**

Possibility of considering Potentials and Fields as Quantities having Density: New Type of Quadrivector.—É. Durand. (*C. R. Acad. Sci., Paris*, 27th Sept. 1954, Vol. 239, No. 13, pp. 751–753.)

538.312 **413**

On Multipole Expansions in the Theory of Electromagnetic Radiation.—C. J. Bouwkamp & H. B. G. Casimir. (*Physica*, Aug. 1954, Vol. 20, No. 8, pp. 539–554.) "A new method is developed for expanding the electromagnetic field of radiating charges and currents in multipole components. Outside a sphere enclosing all sources, the field is represented in terms of Debye potentials which are shown to be closely related to the radial components of the electric and magnetic vectors. Attention is drawn to remarkably simple source representations of these radial components. A discussion of vector-potential versus Debye-potential representation of multipole fields is included. Only familiarity with ordinary vector calculus is required."

538.56 **414**

The Radiation Green's Functions.—J. G. Linhart. (*J. Franklin Inst.*, Aug. 1954, Vol. 258, No. 2, pp. 99–112.) Analysis for the radiation field of a group of charges is derived using functions similar to the Green's function of potential theory but applied to the time-variables problems of radiation theory. The method presents a model of interaction between a quantum of movement of a unit point charge and the corresponding excitation of a set of eigen-fields; it is illustrated by treating the case of a point charge rotating in a cylindrical cavity.

538.566 : 538.614 **415**

Propagation of Electromagnetic Waves in a Gyrotropic Medium.—M. A. Gintsburg. (*C. R. Acad. Sci. U.R.S.S.*, 1st Aug. 1954, Vol. 97, No. 4, p. 572. In Russian.) Correction to paper abstracted in 2927 of 1954.

538.632/.633 **416**

Direct Comparison of Hall Effect and Corbino Effect.—W. J. Poppelbaum. (*Helv. phys. Acta*, 31st Aug. 1954, Vol. 27, No. 4, pp. 355–394. In French.) By using a cylindrical sample immersed in a radial magnetic field, a transverse current is produced when an alternating voltage is applied between the ends of the cylinder; this transverse current gives rise to an induced voltage in a coaxial coil. Both the Corbino and the Hall effects can be measured with this arrangement, thus providing two independent means of determining the Hall constant; the discrepancy between the two results is $< 5\%$.

621.3.032.44 **417**

The Distribution of Temperature along a Thin Rod Electrically Heated in Vacuo: Parts 2–4.—S. C. Jain & K. S. Krishnan. (*Proc. roy. Soc. A*, 6th Aug. 1954, Vol. 225, No. 1160, pp. 1–32.) The theoretical solution presented in part 1 (2375 of 1954) is considered in the light of formulae discussed by Stead (*J. Instn elect. Engrs*, 1920, Vol. 58, p. 10) relating the temperature distribution in a finite rod to that in an infinitely long rod heated by the same current. A useful expression is found for the temperature at the centre of a finite long rod as a function of its length. Detailed experimental verification of the main theoretical results is reported. Empirical formulae proposed by Worthing are shown to follow from the theory developed.

53·05 **418**

The Physics of Experimental Method. [Book Review]—H. J. J. Braddick. Publishers: Chapman & Hall, London, 404 pp., 35s. (*Phil. Mag.*, Aug. 1954, Vol. 45, No. 367, p. 884.) Sections are included on relevant mathematics, mechanical construction and materials, vacuum technique, electrical measurements and electronics, optics and photography, natural limits of measurements, and techniques of nuclear physics.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **419**

A Comparison of the Intensity Distribution of Radio-Frequency Radiation with a Model of the Galactic System.—G. Westerhout & J. H. Oort. (*Bull. astr. Insts Netherlds*, 26th Aug. 1951, Vol. 11, No. 426, pp. 323–333. In English.) A comparison is made between the radiation to be expected from objects distributed like the common stars and the observed r.f. radiation. Satisfactory agreement with Bolton & Westfold's observations on 100 Mc/s (348 of 1951) is obtained for the regions where the radiation is considerable. Near the galactic poles and in the hemisphere opposite the centre the observed temperatures are about 600° in excess of the calculated values; this excess is possibly due to a background of distant extragalactic nebulae.

523.16 **420**

Methods and Results of Radio Astronomy.—H. Siedentopf. (*Z. angew. Phys.*, Aug. & Sept. 1954, Vol. 6, Nos. 8 & 9, pp. 376–384 & 422–430.) A survey with over 100 references.

523.5 : 621.396.96 **421**

Radio Observations of Meteors.—P. M. Millman. (*Science*, 27th Aug. 1954, Vol. 120, No. 3113, pp. 325–328.) A summarized general account, with literature references, of the most significant results obtained during the seven years up to the end of 1953.

523.746.5 **422**

Present Phase of Solar Cycle.—D. E. Trotter & C. Pecker. (*C. R. Acad. Sci., Paris*, 6th Sept. 1954, Vol. 239, No. 10, pp. 633–635.) Observations of the intensity of the coronal 5303-Å green line suggest that the 1954 minimum of solar activity is flatter and lower than that of 1944; a first indication of the rise of the new cycle was observed at the beginning of August 1954. The next maximum is expected to occur between summer 1959 and the end of 1960 and to be rather low.

550.385 **423**

The Prediction of Geomagnetic Disturbances.—J. C. Pecker & W. O. Roberts. (*C. R. Acad. Sci., Paris*, 6th Sept. 1954, Vol. 239, No. 10, pp. 635–637.) Shapley's method for predicting geomagnetic indices (*Trans. Amer. geophys. Union*, 1947, Vol. 28, p. 715) is modified to take account of (*a*) the variation of the periodicity of the disturbance about the 27-day average, and (*b*) the maxima observed in the values of the indices in March and September.

551.510.53 + 621.396.11 **424**

Rocket Exploration of the Upper Atmosphere.—R. L. F. Boyd, M. J. Seaton & H. S. W. Massey, Eds. (*J. atmos. terr. Phys.*, 1954, Special Supplement, Vol. 1, 376 pp.) The text is given of 49 papers read at a conference at Oxford in August 1953. Sections 1–3 cover rocket techniques, atmospheric phenomena and composition of the high atmosphere. Section 4 deals with the ionosphere in particular and includes papers on wave-propagation measurements made using rockets (reported earlier), a specially designed aerial used on dry rocky soil for short-range sky-wave measurements at l.f., an analysis of a method of determining charge densities from rocket-tracking data, and a suggested programme of rocket-borne-magnetometer measurements. Section 6 covers laboratory studies, including an experiment on cross-modulation.

551.510.535 **425**

Study of Layer Splitting in the Ionosphere.—O. Burkard. (*Arch. Met. A, Wien*, 30th June 1954, Vol. 7, pp. 283–291.) An equation is derived expressing the conditions for one or more maxima to occur in the height distribution of electron concentration, for arbitrary height distributions of temperature and recombination coefficient. A numerical treatment is given for splitting into F_1 and F_2 layers. The occurrence of splitting with uniform temperature distribution would imply a highly improbable value for the recombination coefficient. On the other hand, the presence of a warm layer within the F layer would lead to results consistent with the observations.

551.510.535 **426**

Absorption of Short Waves in the Ionosphere.—É. Argence & K. Rawer. (*C. R. Acad. Sci., Paris*, 27th Sept. 1954, Vol. 239, No. 13, pp. 773–775.) Expressions are derived analytically for the value of the decrement δ_2 for values of the frequency above and below critical, assuming that collisions of electrons with ions are much more numerous than with neutral molecules.

551.510.535 : 523.16 **427**

High Latitude Ionospheric Observations using Extraterrestrial Radio Waves.—C. G. Little. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1700–1701.) A preliminary account is given of observations made at College, Alaska, over a two-month period in the spring of 1954, of the effect of the ionosphere on the reception of cosmic radiation at 65 Mc/s. Strong absorption of the diffuse r.f. background is most common at midday and least common during late evening; it is correlated with no-echo conditions and with variations of the geomagnetic field. Observations on localized radio sources indicate that scintillations are commoner in Alaska than in England. Scintillations were observed whenever marked 65-Mc/s absorption occurred during transit of the localized source through the aerial beam; this indicates that the lateral distribution of ionization during periods of absorption is nonuniform. Study of the scintillations should provide information about irregularities in the ionosphere.

551.510.535 : 538.566 **428**

The Propagation of Long Electric Waves round the Earth in relation to Transmission Interference and Lightning Atmospherics.—Schumann. (See 528.)

551.594.21 **429**

An Analysis of Electric Field after Lightning Discharges.—Y. Tamura. (*J. Geomag. Geoelect.*, March 1954, Vol. 6, No. 1, pp. 34–46.) The thundercloud is represented by a vertical dipole, and the e.m.f. in it is represented by a constant current generator. The electric field comprises components due to (*a*) the charge on each pole, which depends on the conductivity of the air, (*b*) space charge related to the charge on the poles, and (*c*) free decaying space charge released after a lightning discharge. Dissimilarity between the field recovery curves for near discharges and distant discharges are explained by this theory.

551.594.6 : 621.396.11.029.45 **430**

Theoretical Calculations of Field of Low-Frequency Electromagnetic Waves above Earth's Surface.—Al'pert. (See 535.)

LOCATION AND AIDS TO NAVIGATION

621.396.93 : 551.594.6 **431**

The Accuracy of the Location of Sources of Atmospherics by Radio Direction-Finding.—F. Horner. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 383–390.) An investigation of the accuracy of the United Kingdom network of twin-channel cathode-ray direction finders operating at frequencies near 10 kc/s is reported. Hilly terrain and buried cables have caused errors of several degrees at some stations. Instrumental errors are small, apart from polarization errors, which may be as high as 2° or 3° in summer day-time and rather higher in winter. An estimate has been made of the accuracy of storm location, the potential accuracy depends not only on bearing errors, station spacing, and storm distance, but also on the number and interpretation of the observations. With the existing network and technique, the probable error in position of a storm centre distant 1 000 km is about 20 km on a summer day, 50 km on a winter day, and 100 km by night.

621.396.933 **432**

Navaglobe-Navarho Long-Range Radio Navigational System.—C. T. Clark, R. I. Colin, M. Dishal, I. Gordy & M. Rogoff. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 155–166; *Convention Record Inst. Radio Engrs*, 1954, Vol. 2, Part 5, pp. 88–97.) The navaglobe system developed for the U.S.A.F. is described; reliability is achieved by operating at a frequency of about 100 kc/s, and tolerable signal/noise ratio at long range by using a bandwidth of 20–100 c/s. The service is omnidirectional and the airborne bearing indications are automatic. Arrangements for reducing the effects of atmospheric noise are described. Performance on transcontinental and transatlantic tests is reported. Plans to complete the system by incorporating phase-comparison distance-measurement equipment are discussed.

621.396.933 **433**

Fixed-Beam Aircraft Approach System.—R. A. Hampshire. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 189–197; *Convention Record Inst. Radio Engrs*, 1954, Vol. 2, Part 5, pp. 77–83.) A system designed for the U.S.A.F. and compatible with existing instrument-approach installations consists of a localizer operating at a frequency between 108 and 112 Mc/s and glide-slope equipment operating at a frequency between 329 and 335 Mc/s, both using modulation at 90 and 150 c/s. The localizer is of dual-beam type.

621.396.96 **434**

Influence of the Polarization of the Radiated Waves on Radar Detection.—G. Pircher. (*C. R. Acad. Sci., Paris*, 27th Sept. 1954, Vol 239, No. 13, pp. 756–757.) Analysis for elliptically polarized radiation is based on a polarization factor which is given by the scalar product of unit vectors representing respectively the transmitter and receiver polarizations. It is shown that for one particular polarization of the radiated waves the echo is annulled, and that for any obstacle there is one particular polarization which gives maximum echo power.

621.396.962.23 **435**

Radar offers Solution to Midair Plane Collisions.—J. Q. Brantley. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 146–150.) Early indication of collision danger is obtained by use of c.w. Doppler technique to measure closure rate, deviation of closure rate and deviation of closure angle. Suitable circuits are described.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **436**

Ultimate Vacuum in a Vacuum-Enclosed Ionization Gauge.—L. J. Varnerin, Jr, & D. White. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1207–1208.) Brief report of measurements made with a Bayard-Alpert gauge.

533.583 : [546.821 + 546.831 **437**

Investigation of Absorption Capacity of Non-dispersal [contact] **Getters.**—E. Lyubovskaya & A. Ravdel'. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1392–1400.) The sorption of hydrogen and oxygen by Zr getters and by Ti getters containing some Th was investigated in the range between room temperature and $\sim$ 700°C. Results, which are presented graphically, indicate that both getters are suitable for use in valves in the range investigated. The sorption capacity of Zr is highest at $\sim$ 500°C for H_2 and increases monotonically for O_2 above $\sim$ 400°C; for TiTh getters the corresponding temperatures are 400°–600°C and $>$ 500°C, respectively. At optimum temperatures Zr absorbs more O_2 than does the TiTh getter; the reverse is true for the H_2 sorption. The rate of sorption was also investigated.

535.215 **438**

Photoconductivity.—A. Rose. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 645–651.) Discussion of photoconduction mechanism in normally poor conductors such as CdS single crystals, pointing out discrepancies between experimental results and simple theory, and illustrating how energy-level distributions in the forbidden bands can be determined by development of suitable theoretical models. See also 1005 of 1952.

535.215.1 : 546.482.31 **439**

Photoconductivity in Cadmium Selenide.—H. J. Dirksen & O. W. Memelink. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 205–215.) Published theories are discussed and a new theory is proposed. Values of the material constants calculated from the theory are in good agreement with results of measurements on CdSe in its basic form and in the form of thin films.

535.37 : 546.561-31 **440**

Nature of Luminescence of Copper Oxide.—Yu. I. Karkhanin & V. E. Lashkarev. (*C. R. Acad. Sci. U.R.S.S.*, 21st Aug. 1954, Vol. 97, No. 6, pp. 1007–1010. In Russian.) A brief report is presented summarizing recent experimental results. It is concluded that Cu vacancies do not luminesce by themselves, but that luminescence is produced at those centres which force the exciton to radiate on annihilation. The wavelength of the infrared luminescence of Cu_2O is about $0{\cdot}96\,\mu$ at 20°C and $0{\cdot}93\,\mu$ at -180°C.

535.376 **441**

Experiments on Electroluminescence.—J. F. Waymouth & F. Bitter. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 941–949.) Observations on green-luminescent ZnS:Cu:Pb and yellow-luminescent ZnS:Cu:Pb:Mn phosphors are reported. The optical and electrical response of the materials to applied electric fields was studied for dispersions in lucite and for individual particles. Luminescence in alternating fields is restricted to spots very much smaller than the individual particles, and occurs only once per cycle. The results indicate that the most important excitation process involves removal of electrons from luminescent centres, luminescence occurring when the state of the field allows the electrons to return and recombine.

537.227 : 546.431.811.824-31 **442**

Ferroelectric Properties of Solid Solutions of Barium Stannate in Barium Titanate.—G. A. Smolenski & V. A. Isupov. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1375–1386.) Solid solutions containing up to 30% molar of $BaSnO_3$ were investigated. Measurements were made of the dielectric constant in weak fields, the resonance and antiresonance frequencies and the fractional elongation $\Delta l/l$ over the temperature range − 150° to + 150°C. In several cases, the dependence of the dielectric constant on the field strength (up to ~ 8 kV/cm) was also determined. Phase transitions were also investigated. The preparation of the specimens and experimental details are described and results are presented graphically and in some cases also in tabulated form.

537.227 : 546.431.817.824-31 **443**

X-Ray Study of Structure of $(Ba,Pb)TiO_3$ Solid Solutions.—E. G. Fesenko & A. G. Slabchenko. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1288–1290.)

537.227 : 546.431.824-31 **444**

Pressed Barium Titanate Piezoelectric Materials.—A. I. Kogan & M. M. Kitaigorodski. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1371–1374.) The dielectric constant and the piezoelectric modulus d_{11} were determined experimentally for polarized $(Ba,Pb)TiO_3$ specimens containing up to 18% Pb. The dielectric constant lies between 40 and 95 and is practically constant at frequencies between 50 kc/s and 12 Mc/s; d_{11} varies between $0{\cdot}6 \times 10^{-7}$ and 10×10^{-7} c.g.s.e. The effect of temperature and length of the thermal pretreatment was investigated. Results are tabulated.

537.227 : 546.431.824-31 **445**

Domain Formation and Domain Wall Motions in Ferroelectric $BaTiO_3$ Single Crystals.—W. J. Merz. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 690–698.) Continuation of work reported previously (759 of 1953). Nucleation and growth of the domains were studied as a function of applied electric field and temperature. The manner of growth of new domains on reversing the polarity of the applied field is discussed in relation to processes observed in ferromagnetic materials and to switching processes when the crystals are used as storage units. Compared with Fe, the walls in $BaTiO_3$ are much thinner and the energy density in the walls is somewhat greater. Since there is practically no sideways motion of the side walls, there is no crosstalk between different sets of electrodes on the same crystal even when they are spaced as closely as 0·01 cm.

537.227 : 546.431.824-31 **446**

Dielectric Constant and Loss Measurements on Barium Titanate Single Crystals while Traversing the Hysteresis Loop.—M. E. Drougard, H. L. Funk & D. R. Young. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1166–1169.) Permittivity measurements were made with small-amplitude sinusoidal voltages of frequency 100–600 kc/s superposed on a bias voltage switched at 10–200 c/s. Results indicate that the frequency dependence of the permittivity and loss is consistent with a relaxation mechanism with a relaxation time of 5·5 μs. See also 3245 of 1954 (Drougard & Young).

537.227 : 621.375.5 **447**

Ferroelectrics and the Dielectric Amplifier.—W. P. Mason & R. F. Wick. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1606–1620.) Properties of $BaTiO_3$ single crystals and ceramics are reviewed in relation to their use for capacitors, transducers, dielectric amplifiers, etc. By adding $PbTiO_3$ and $CaTiO_3$ the ceramics can be stabilized so as to be satisfactory for electromechanical filters and delay lines. For use in dielectric amplifiers and signal-storage units, single crystals are more suitable than ceramics by virtue of their narrower hysteresis loop. Experiments are briefly reported on dielectric amplifiers with crystals of thickness 0·002 in. operated below the Curie temperature; these crystals are saturated by a voltage of 10 V, and their hysteresis loops do not vary with frequency up to 200 kc/s or higher. The amplifier has a gain of about 12 db for modulation frequencies up to 7 kc/s.

537.311.33 : 535.215 **448**

Photovoltaic Effect in InAs.—R. M. Talley & D. P. Enright. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 1092–1094.) Report of measurements of the spectral variation of the photovoltaic effect in InAs *p-n* junctions.

537.311.33 : 536.21.022 **449**

Some Regularities in the Magnitudes of Thermal Conductivities of Semiconductors.—A. V. Ioffe & A. F. Ioffe. (*C. R. Acad. Sci. U.R.S.S.*, 11th Aug. 1954, Vol. 97, No. 5, pp. 821–822. In Russian.) The decrease in thermal conductivity with increase in atomic or molecular weight, and, in the case of ionic-lattice compounds, also with increase in the ratio of the atomic weight of the positive to that of the negative constituent element, is shown graphically. The semiconductors considered include alkali halides, AgCl, AgBr, TlCl and TlBr, diamond, Si, Ge, GaSb, and InSb.

537.311.33 : 537.312.8 **450**

Transverse Galvanomagnetic Effects in Semiconductors.—J. Appel. (*Z. Naturf.*, Feb. 1954, Vol. 9a, No. 2, pp. 167–174.) The investigation reported by Johnson & Whitesell (2329 of 1953) is extended to magnetic fields of any strength. The value found for the magnetoresistance with strong fields and high carrier mobilities is much greater than that given by Harding's theory (*Proc. roy. Soc. A*, 1933, Vol. 140, p. 205) and is in agreement with experimental results reported by Estermann & Foner (661 of 1951) and by Pearson & Suhl (166 of 1952). The two-band model is considered; the influence of intrinsic conduction on the magnetoresistance of Ge at room temperature and the change of sign of the Hall constant in some circumstances are discussed.

537.311.33 : 539.234 **451**

Evaporated Multiple Layers with Semiconductor Properties.—J. C. M. Brentano & J. D. Richards. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 841–843.) Thin multiple-layer films were deposited on pyrex in vacuum by alternate evaporation of two metals not likely to form intermetallic compounds or alloys. The experimentally observed variation of resistivity with temperature is plotted for a film comprising 210 layers each of Fe and Pb; the temperature coefficient of resistivity is negative. For films of either Fe or Pb alone, produced under similar conditions, the temperature coefficients are negligible or positive. The significance of this difference is discussed in relation to the lattice structure.

537.311.33 : 546.28 **452**

Formation of Single-Crystal Silicon Fibers.—E. R. Johnson & J. A. Amick. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1204–1205.) Details are given of fibres formed when $SiCl_4$ diluted with a carrier gas is caused to react with Zn vapour at a temperature of 800°–1 000°C. The average diameter of the fibres is about 1 μ and the lengths are up to 1 cm.

537.311.33 : 546.28 453

Hyperfine Splitting in Spin Resonance of Group V Donors in Silicon.—R. C. Fletcher, W. A. Yager, G. L. Pearson & F. R. Merritt. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 844–845.) Continuation of investigations reported previously [3254 of 1954 (Fletcher et al.)]. Samples with various concentrations of P, Ar and Sb have been studied; with all three donors, the multiplicity of resonance lines is replaced by a single narrow line when the concentration exceeds a certain value.

537.311.33 : 546.28 454

Precipitation of Impurities at Dislocations in Heat-Treated Silicon.—S. Mayburg. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 838–839.) Results of experiments indicate that impurities are precipitated at dislocations when Si single crystals are heated at temperatures below 900°C. The heating was performed in vacuum by passing current through the specimens, and the effects were studied by measurements of the room-temperature conductivity after quenching. The critical temperature of 900°C is that at which plastic deformation is first observed in Si; a similar critical point is observed in Ge at about 500°C [2430 of 1954 (Fuller et al.)].

537.311.33 : [546.289 + 546.28 + 546.24 455

Effect of Surface Levels on Electrical Properties of Fine-Grain Films of Ge, Si, and Te.—Ya. E. Pokrovski. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1229–1243.) The Hall coefficient and resistivity of films prepared by condensation in vacuum were determined over the temperature range from about − 180°C up to several hundred degrees C. The grain dimensions, which were in the region of 10^{-5}–10^{-6} cm, were controlled by using thin quartz base plates at various temperatures. Results, which are presented graphically, indicate that the surface levels of Ge are acceptor levels filled, at room temperature, with electrons at a density of about $3{\cdot}5 \times 10^{11}$ cm^{-2}; the activation energies of the surface levels are about 0·004, 0·02 and 0·055 eV. The properties of Si films can be explained if it is assumed that an empty band lies just above a filled surface band, both near the middle of the forbidden band. Te has acceptor surface levels lying above the filled band.

537.311.33 : 546.289 456

Ionization Energies of Groups III and V Elements in Germanium.—T. H. Geballe & F. J. Morin. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 1085–1086.) Experiments indicate that differences between the ionization energies of Group-III acceptors and Group-V donors in Ge are similar to, but less pronounced than, those previously reported for Si [*Bull. Amer. phys. Soc.*, 1954, Vol. 29, No. 5, p. 22 (Morin et al.)].

537.311.33 : 546.289 457

Theory of Dislocations in Germanium.—W. T. Read, Jr. (*Phil. Mag.*, Aug. 1954, Vol. 45, No. 367, pp. 775–796.) Theory is discussed quantitatively on the basis of a model due to Shockley (*Phys. Rev.*, 1953, Vol. 91, p. 228). In *n*-type Ge a dislocation gives rise to a row of acceptors; the space charge which develops as these accept electrons has a controlling influence in determining the occupation of the remaining centres. Formulae are derived for the temperature variation of the average electron concentration in slightly deformed specimens. Experimental methods for testing the theory are suggested.

537.311.33 : 546.289 : 541.135 458

Self-Powered Semiconductor Amplifier.—C. G. B. Garrett & W. H. Brattain. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 1091–1092.) A slice of *n*-type Ge with an In-alloyed emitter on one surface has its other surface exposed to a suitable electrolyte. Another electrode having a half-cell potential higher than that of Ge is also placed in the electrolyte. Connections are made to the In, to a gold-bonded contact on the Ge, and to the other electrode. Such a unit constitutes an amplifier incorporating its own power supply, multiplication of holes taking place at the Ge/electrolyte surface. Measured values between 1·4 and 2·0 have been obtained for the current gain. The cut-off frequency is comparable to that of a transistor of similar dimensions.

537.311.33 : 546.3-1-28-289 459

Energy Gap of Germanium-Silicon Alloys.—A. Levitas, C. C. Wang & B. H. Alexander. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, p. 846.) Measured values of energy gap are shown graphically against alloy composition.

537.311.33 : 546.3-1-28-289 460

Speculations on the Energy-Band Structure of Ge-Si Alloys.—F. Herman. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 847–848.)

537.311.33 : 546.46-31 461

Electrical Conductivity of Magnesium Oxide Single Crystals.—E. Yamaka & K. Sawamoto. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 848–850.) Results of experiments indicate that the 2·3-eV energy level available to the charged carriers originates from excess Mg and not from excess O atoms.

537.311.33 : 546.682.18 462

Optical Properties of Indium Phosphide in the Infrared.—F. Oswald. (*Z. Naturf.*, Feb. 1954, Vol. 9a, No. 2, p. 181.) Report of measurements over the wavelength range 0·8–15·2 μ on an *n*-type specimen of resistivity 0·1Ω.cm. A sharp absorption edge is found corresponding to an energy gap of 1·25 eV. Absorption observed at wavelengths > 14·5 μ may be due either to an impurity or to the lattice vibrations.

537.311.33 : [546.682.86 + 546.289 463

Analysis of Magnetoresistance and Hall Coefficient in *p*-Type Indium-Antimonide and *p*-Type Germanium.—T. C. Harman, R. K. Willardson & A. C. Beer. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 699–702.) Existing theory is re-cast in a form convenient for the analysis of experimental results. For *p*-type InSb good agreement is obtained between experimental and theoretical results; in the case of *p*-type Ge the theory is not capable of explaining the experimentally observed variations of Hall coefficient with magnetic field or of magnetoresistance with temperature.

537.311.33 : 546.722-31 464

Application of R.F. Absorption in Iron Oxides to the Determination of the Activation Energy of their Lattice Defects.—B. Hagène. (*J. Phys. Radium*, July/Sept. 1954, Vol. 15, Nos. 7/9, pp. 583–584.) Continuation of work reported previously [2328 of 1953 (Freymann et al.)]. Examination of experimental curves in the light of the formula relating frequency of maximum Debye absorption to absolute temperature indicates that for iron oxide mixtures in one group the activation energy is ~ 0·1 eV, probably related to defects due to the presence of Fe_3O_4. For another group the activation energy is 0·5–0·9 eV, possibly corresponding to an electronic phenomenon. The activation energy of αFe_2O_3 is 0·4 eV and of γFe_2O_3 0·07 eV.

537.311.33 : 548.53 **465**

Solute Redistribution by Recrystallization.—R. G. Pohl. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1170–1178.) Theoretical investigation of the modification of the distribution of impurities in a melt of metal or alloy during solidification. Results are presented graphically and tabulated, and are compared with previously published findings.

537.311.33 : 621.314.7 **466**

Transistor Electronics: Imperfections, Unipolar and Analog Transistors: Parts 2 & 3.—W. Shockley. (*Proc. Instn Radio Engrs, Aust.*, Aug. & Sept. 1954, Vol. 15, Nos. 8 & 9, pp. 194–201 & 228–234.) Reprint, see 746 of 1953. Part 1 : 3600 of 1954.

537.582 **467**

Thermionic Constants of Metals and Semiconductors: Part 4—Monovalent Metals (continued).—S. C. Jain & K. S. Krishnan. (*Proc. roy. Soc. A*, 31st Aug. 1954, Vol. 225, No. 1161, pp. 159–172.) Regarding the electrons in the metal and in the vapour phase as a single-component thermodynamic system, the temperature coefficient of the work function ϕ corresponds to an apparent lowering of Richardson's constant A by about 8–10%. This agrees with experimental results. The effects of thermal expansion of the lattice and thermal agitation of the atoms on ϕ practically cancel each other, so that the observed variation of ϕ with temperature may be regarded as due to electronic specific heat alone. Part 3: 2700 of 1953.

538.221 **468**

The Spontaneous Magnetization of Alloys: Part 1 — Copper Nickel Alloys.—D. J. Oliver & W. Sucksmith. (*Proc. roy. Soc. A*, 11th Aug. 1953, Vol. 219, No. 1136, pp. 1–17.) Report and discussion of measurements made to determine the variation of spontaneous magnetization with temperature. A magnetothermal method gives a curve below that obtained from purely magnetic measurements. The relation of the magnetocaloric temperature rise to the square of the magnetization is nonlinear above the Curie point.

538.221 **469**

Temperature of Heating in Thermomagnetic Treatment of Magnico Alloy.—G. F. Golovin & A. A. Shekalov. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1503–1507.) The effect was investigated experimentally of various heat treatments of the alloy (50·5% Fe–23·6% Co–13·6% Ni–8·6 % Al–3·0 % Cu–0·05 % C) on the structure and magnetic properties. Results are presented graphically and microphotographs of surface structure are shown.

538.221 **470**

A Theory of Domain Creation and Coercive Force in Polycrystalline Ferromagnetics.—J. B. Goodenough. (*Phys. Rev.*, 15th Aug. 1954, Vol. 95, No. 4, pp. 917–932.) "Granular inclusions, grain boundaries, lamellar precipitates, and the crystalline surface have been examined as possible nucleation centers for domains of reverse magnetization in ferromagnetic materials. It is concluded that the surface density of magnetic poles at the grain boundaries is the most common source of nucleation energy in polycrystalline materials. The concept of nucleation of domains of reverse magnetization has led to a calculation of three more terms which may contribute to the coercive force in polycrystalline materials, viz., a grain-boundary, a lamellar-precipitate, and a domain-wall-surface-tension contribution. The theoretical predictions are compared with several old experiments. New insight is gained on the problem of stress sensitivity of polycrystalline ferromagnetics and B-H loop shape."

538.221 : 538.114 **471**

Theory of Ferromagnetic Resonance and Results of Experimental Investigation.—K. H. Reich. (*Z. angew. Phys.*, July 1954, Vol. 6, No. 7, pp. 326–338.) A survey of experimental and some theoretical work, with particular reference to Kittel's theory. Eighty-three references include work up to 15th October 1953; several more recent references are given in the addendum.

538.221 : 538.652 **472**

Investigation of Magnetostriction of Iron-Nickel Alloy in Strong Magnetic Fields.—G. P. D'yakov & R. A. Reznikova. (*C. R. Acad. Sci. U.R.S.S.*, 1st Aug. 1954, Vol. 97, No. 4, pp. 633–634. In Russian.) An experimental investigation of wires of composition 41% Fe and 59% Ni is reported. Plotting $\lambda_s-\lambda$ against H^{-2}, where λ_s is the saturation magnetostriction and H the magnetizing field, results in a straight line the slope of which is $32K^2\,\lambda_s/35J_s^2$, where K is a magnetic anisotropy constant and J_s the saturation magnetization. The result is briefly discussed.

538.221 : 538.652 **473**

Magnetostriction of Ferromagnetic Alloys based on Manganese.—D. I. Volkov. (*C. R. Acad. Sci. U.R.S.S.*, 11th Aug. 1954, Vol. 97, No. 5, pp. 809–811. In Russian.) The materials investigated comprised the binary Mn alloys with Sb, Bi and Sn, and alloys of the type Cu-Mn-X, where X is Al, Sn, or Bi. Several of these are highly magnetostrictive both at room temperature and at − 195°C. The magnetostriction of 31·2% Mn–68·8% Sb rises to a value more than twice that of Ni at saturation; the longitudinal magnetostriction of 30·9% Cu–14% Mn–55·1% Bi is about -140×10^{-6} at saturation, a value nearly equal to that for the best Pt-Fe alloy investigated by Kussmann & von Rittberg (2788 of 1950). Experimental curves are given for several alloys.

538.221 : 538.652 **474**

A Peculiarity of Magnetostrictive Properties of Mn-Sn Ferromagnetic Alloys.—D. I. Volkov & V. I. Leont'ev. (*C. R. Acad. Sci. U.R.S.S.*, 21st Aug. 1954, Vol. 97, No. 6, pp. 995–997. In Russian.) Results are reported of an experimental determination of the longitudinal, transverse and volume magnetostriction in Mn-Sn alloys containing between 42 and 48% Mn, at temperatures of −78° and − 195°C. All three magnetostriction coefficients were found to be negative at saturation.

538.221 : 621.318.134 **475**

The Spontaneous Magnetization of Alloys and Compounds: Part 2—Ferrites.—C. A. Clark & W. Sucksmith. (*Proc. roy. Soc. A*, 31st Aug. 1954, Vol. 225, No. 1161, pp. 147–159.) Magnetic and magnetocaloric measurements have been made on Mn ferrite and Mg-Zn ferrite. Values of spontaneous magnetization obtained by three extrapolation techniques are similar; this agreement is maintained at temperatures about the Curie point, in contrast to the results for ferromagnetic materials [part 1: 468 above (Oliver & Sucksmith)]. The saturation magnetization of both ferrites and the reduced-magnetization/reduced-temperature curve for Mn ferrite are in satisfactory agreement with Néel's theory.

538.221 : 621.318.134 **476**

Magnetic Ferrites: New Materials for Modern Applications.—V. E. Legg & C. D. Owens. (*Elect. Engng, N.Y.*, Aug. 1954, Vol. 73, No. 8, pp. 726–729.)

Review of properties and applications of different ferrites, with a note on manufacturing processes. Typical characteristics of NiZn, MnZn and Ni ferrites are tabulated. Q values and applications in different frequency ranges are listed.

538.247 **477**

Investigation of Hysteresis of Ballistic Demagnetization Factor.—A. P. Lyustrova & V. A. Lipatova. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1513–1519.) An experimental investigation is reported. Soft and hard ferromagnetic specimens in prismatic form were used.

621.315.61 : 537.533.8 **478**

A Method of investigating the Secondary Emissive Properties of Insulators.—C. N. W. Litting. (*Brit. J. appl. Phys.*, Aug. 1954, Vol. 5, No. 8, pp. 289–293.) The method is limited to surfaces with $\delta > 1$. The insulator under investigation is in contact with a backing plate to which is applied a square wave whose mark/space ratio is varied to obtain zero net loss of charge from the surface over a complete cycle. The mark/space ratio of this waveform is then used to compute the value of δ. Results obtained from simultaneous measurements using this method and a d.c. one show very good agreement. Difficulties are discussed. The method may also be used to determine the energy distribution of the secondary electrons.

621.315.612 : 537.226.31 **479**

Dielectric Losses in High-Frequency Ceramics.—N. P. Bogoroditski & I. D. Fridberg. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1194–1204.) A discussion of previously published experimental results is used as a basis for classifying dielectric loss mechanisms; seven main types are tabulated and the conditions for these losses to be low or high are stated.

621.315.612 : 621.385.032 **480**

Advances in Ceramics related to Electronic Tube Developments.—L. Navias. (*J. Amer. ceram. Soc.*, 1st Aug. 1954, Vol. 37, No. 8, pp. 329–350.) A detailed study is made of the physical properties of alumina, forsterite, zircon-talc and steatite in relation to the requirements of valves for operation in the 3-cm waveband. The development of sealing techniques is described, and details are given of methods of making ceramic/metal seals using (*a*) Mn-Mo, (*b*) MoO_3 or (*c*) TiH_2 as the metallizing agent.

621.315.613.1 **481**

Three Forms of Synthetic Micas.—T. B. Merrill, Jr. (*Mater. & Meth.*, Aug. 1954, Vol. 40, No. 2, pp. 80–83.) Discussion of the preparation, properties and uses of material obtained by (*a*) glass-bonding finely powdered mica, (*b*) reconstituting small flakes into sheets by calendering, or (*c*) hot-pressing finely powdered mica into homogeneous blocks.

621.791.3 : 546.621 **482**

Soldering Aluminium.—J. C. Bailey & J. A. Hirschfield. (*Research, Lond.*, Aug. 1954, Vol. 7, No. 8, pp. 320–326.) A review is presented of methods, materials, techniques and applications. Tables are given of the composition of various solders and their melting points, and of results of breaking and tensile strength tests on soldered joints. Solder embrittlement and corrosion are also discussed.

MATHEMATICS

517 **483**

On the Behavior of the Solutions of the Differential Equation $\Delta U = F(x, U)$ in the Neighborhood of a Point.—C. Müller. (*Commun. pure appl. Math.*, Aug. 1954, Vol. 7, No. 3, pp. 505–515.) An equation involved in the theory of e.m. oscillations is investigated.

517.9 **484**

An Extended Use of Perturbation Theory.—R. N. Gould & A. Cunliffe. (*Phil. Mag.*, Aug. 1954, Vol. 45, No. 367, pp. 818–822.) A method of solving partial differential equations arising in boundary-layer problems is given.

517.7 **485**

Handbook of Elliptic Integrals for Engineers and Physicists. [Book Review]—P. F. Byrd & M. Friedman. Publishers: Springer, Berlin, 1954, 355 pp., 36 DM. (*Arch. elekt. Übertragung*, Sept. 1954, Vol. 8, No. 9, p. 403.)

518.3 **486**

Leitfaden der Nomographie. [Book Review]—W. Meyer zur Capellen. Publishers: Springer, Berlin, 1953, 178 pp., 17.40 DM. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, p. 384.) The theoretical bases of nomography are presented and numerous examples and applications are given.

MEASUREMENTS AND TEST GEAR

621.3.018.41(083.74) + 529.786] : 538.569.4 **487**

Atomic Clocks and Frequency Standards on an Ammonia Line: Parts 2 & 3.—K. Shimoda. (*J. phys. Soc. Japan.*, July/Aug. 1954, Vol. 9, No. 4, pp. 558–575.) Use of the Zeeman and Faraday effects for eliminating causes of error in atomic clocks is examined. The nonreciprocal transmission characteristics of a waveguide absorption cell in an axial magnetic field are investigated theoretically in relation to the design of a highly accurate clock. An arrangement is described which makes use of Stark, source and Zeeman modulation and is free from errors due to reflections in the microwave line. Preliminary results using a cell of length 1 m indicate that accuracy within 10^{-9} is obtainable.

621.3.018.41(083.74) : 621.373.421.13 **488**

Audio and R. F. Secondary Frequency Standard.—R. C. Moses. (*Radio-Electronic Engng*, Aug. 1954, Vol. 23, No. 2, pp. 16–18 .. 31.) The frequency standard supplies sine-wave and square-wave outputs at five frequencies between 1 kc/s and 100 kc/s, and harmonics of a basic 100-kc/s oscillator up to 150 Mc/s. The 100-kc/s master oscillator is maintained at constant temperature and operated at very low power level. Supplementary crystal-stabilized 1-Mc/s and 10-Mc/s oscillators are used. The frequency divider comprises cascaded decade-scaling circuits with stability dependent primarily on tuned *LC* circuits.

621.316.84(083.74) **489**

Enclosed Standard Resistors.—A. Schulze & H. Zacherl. (*Z. angew. Phys.*, July 1954, Vol. 6, No. 7, pp. 324–326.) The construction of the Au-Cr resistor [772 of 1953 (Schulze & Eicke)] and of the manganin resistor is modified to make it watertight. Helium is found to provide the best atmosphere for the Au-Cr type, argon or nitrogen for the manganin type.

621.317.3 **490**

Measurement Methods.—(*Fernmeldetech. Z.*, Aug. 1954, Vol. 7, No. 8, pp. 379–436.) A special number including the following papers:

- Measurements on Coaxial Cables (pp. 387–393).—A. Knacke. The pulse reflection method is discussed.
- High-Accuracy Direct-Indicating Frequency Meter (pp. 394–398).—J. Hacks. Equipment using counter circuits is described.
- Development Trends in Impedance Meters for Very High Frequencies (p. 399).—R. Eichaker.
- Ratio Meter for Determination of Admittance, particularly in the U.S.W. Range (p. 400).—H. Fricke.
- Direct Indication of Envelope Delay in the Frequency Range 100 kc/s–5 Mc/s (pp. 401–405).—W. Kaiser & H. Wilde. Variations of envelope transmission time down to 10^{-9} sec are determined from very accurate phase measurements.
- Investigations with a Direct-Indicating Envelope-Delay Meter in the Range 60–90 Mc/s (pp. 406–409).—H. Reiner. Oscillograms are shown of phase-delay characteristics of various quadripoles, i.f. amplifiers and imperfectly terminated cables.
- Methods of Measurement of Impedance at Frequencies up to 10 kMc/s (pp. 410–418).—A. Jaumann. Methods using bridges and directional couplers for measurement of impedance or reflection coefficient are described.
- Noncontacting Plungers for Microwave Instruments (pp. 419–424).—J. Deutsch & O. Zinke. New designs give increased bandwidth and reduced losses.
- Time-Expanding Methods for Cathode-Ray Oscillographs (pp. 425–430).—J. Czech.

621.317.3 : 621.314.7 **491**

Stability Considerations in the Parameter Measurements of V.H.F. Point-Contact Transistors.—D. E. Thomas. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1636–1644.) In early forms of measurement equipment for transistors the α cut-off frequencies involved were low enough for lead impedances and parasitic shunt capacitances to be neglected. Modified forms of equipment are discussed suitable for dealing with later types of transistor having α cut-off frequencies in the v.h.f. range. Negative-resistance collector regions may give rise to discontinuities in the static characteristics. Simple circuits are shown for characteristic-curve tracers with either oscilloscope or X-Y recorder presentation.

621.317.3 : 621.396.674.1 **492**

Generation of Standard Fields in Shielded Enclosures.—F. Haber. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1693–1698.) With the known method of calibrating loop aerials by arranging the loop in the vicinity of a radiating wire inside an enclosure, the boundary conditions in the formulae involved are satisfied for an infinite set of images. Errors are introduced if consideration is limited to one or two images; errors are also caused by frequency limitations. New formulae are derived which give the field strength accurate to within 1% for low and medium frequencies. A method of estimating the error for high frequencies is discussed.

621.317.331 **493**

An Absolute Measurement of Resistance by Albert Campbell's Bridge Method.—G. H. Rayner. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 250–257. Digest, *ibid.*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 574–575.) "Two determinations of the unit of resistance in terms of mutual inductance and frequency were made during 1951 using Campbell's bridge method. They gave the same value within 1 part per million, and the mean value agreed with that found in 1936 to the same accuracy. The value obtained for the ohm as maintained by the group of coils forming the reference standard at the National Physical Laboratory is: 1 N.P.L. ohm = 1.000 002 ± 0.000 015 absolute ohm."

621.317.331 : 621.385.032.216 **494**

Sensitive Apparatus for the Measurement of Cathode Parasitic Resistance.—Sevin. (See 598.)

621.317.333.6.029.62 **495**

A Breakdown Cell for Measuring the Dielectric Strength of Solids at 100 Megacycles.—L. J. Frisco & J. J. Chapman. (*Rev. sci. Instrum.*, Aug. 1954, Vol. 25, No. 8, pp. 733–737.) The cell is liquid-filled and contains the specimen under test, a high-voltage resonant circuit, and a built-in probe for measuring voltage. The calibration of the voltage-measurement network is discussed.

621.317.335 : 621.317.336.029.6 **496**

The Computation of the Complex Dielectric Constant from Microwave Impedance Measurements.—J. P. Poley. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 173–176.) Diagrams supplementing that developed by Benoit (935 of 1950) are presented for facilitating determination of the complex dielectric constant.

621.317.335 : 621.372.413 **497**

Dielectric Measurements with H_{01n} Resonant Cavities having Appreciable Loading.—J. L. Farrands. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 404–406.) "Modifications to the usual formulae for dielectric measurements in H-mode cavities are suggested to allow for damping due to coupling irises. The correction permits the use of low-level sources."

621.317.335.2.029.4 **498**

The Measurement of Capacitance at Low Frequencies.—P. Phillips. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1954, Vol. 15, No. 8, pp. 191–193.) "The fundamental formulae relating to series and parallel equivalent circuits of a lossy capacitor are given and some methods of measuring capacitor properties at low frequencies are discussed."

621.317.335.3(083.74) **499**

Capacitor with Definite Loss Angles for checking Bridge Measurements at Power Frequency.—A. W. Stannett. (*J. sci. Instrum.*, Aug. 1954, Vol. 31, No. 8, p. 304.) Description of improvements to the synthetic "lossy" capacitor constructed to represent a filled oil cell and required in connection with the international comparison of power-factor measurements.

621.317.353 + 621.396.822] : 621.316.8 **500**

New Resistor Voltage-Coefficient Tester.—Rosenthal & Louis. (See 355.)

621.317.42 : 621.385.832 **501**

The Use of an Electron Beam for the Accurate Measurement of Alternating Magnetic Field Strengths.—S. E. Barden & K. Phillips. (*Proc. Instn elect. Engrs*, Part II, Aug. 1954, Vol. 101, No. 82, pp. 441–449; Digest, *ibid.*, Part III, Nov. 1954, Vol. 101, No. 74, p. 406.) A method of making measurements relative to a standard field uses a l.v. electron-optical system which produces a beam if the magnetic field in which it is placed is less than or of the order of 0·01 G. The measurement is based on the voltage pulse produced at field zero. The operation of the instrument in time-varying fields such as those in particle accelerators is discussed.

621.317.44 **502**

An Automatic Plotter for Magnetic Hysteresis Loops.—H. McG. Ross. (*Proc. Instn elect. Engrs*, Part II, Aug. 1954, Vol. 101, No. 82, pp. 417–427. Discussion, pp. 427–430.) An instrument is described with which measurements are made under substantially zero-frequency conditions, the period of the cycle being nearly one minute. The magnetic flux is detected by a search coil on the sample, the e.m.f. being amplified and integrated by a variable-speed motor on the plotting table, whereby the displacement of the pen is a measure of the magnetic induction. Calibration is in terms of voltage and time.

621.317.7 : 621.373.421.1 **503**

Small-Amplitude Oscillator for Capacitive Measurement of the Deflection of Sensitive Rotating Systems.—J. W. Hiby & K. G. Müller. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, pp. 361–363.) In a modified form of the capacitance micrometer using a quartz resonator, described e.g. by Dye (*Proc. phys. Soc.*, 1926, Vol. 38, pp. 399–457), the oscillation amplitude is made very small so that the mechanical force on the oscillator plate is practically zero. Variation from the nominal frequency of 3·17 Mc/s is not more than 5 parts in 10^6. Spontaneous amplitude fluctuations occur when the amplitude falls below 15 $\mathrm{mV_{eff}}$.

621.317.723 **504**

A General-Purpose Electrometer.—R. M. Fry. (*J. sci. Instrum.*, Aug. 1954, Vol. 31, No. 8, pp. 269–271.) An instrument based on the Townsend null method, but incorporating automatic adjustment of the compensating voltage, is described. It is suitable for free-air-chamber work and for extrapolation-chamber work over the current range 10^{-12}–10^{-9} A, and can be adapted for use in a bridge circuit for capacitance measurement.

621.317.729 **505**

Some Applications of the Electrolytic Tank to Engineering Design Problems.—H. Diggle & E. R. Hartill. (*Proc. Instn elect. Engrs*, Part II, Aug. 1954, Vol. 101, No. 82, pp. 349–364. Discussion, pp. 364–368.) The solution of problems relating mainly to electric and magnetic fields is discussed.

621.317.733 : 621.317.4 **506**

A New Method for Measurement of Complex Susceptibility by Magnetic Resonance Absorption in the U.S.W. Range.—W. Müller-Warmuth. (*Naturwissenschaften*, Aug. 1954, Vol. 41, No. 16, p. 368.) A bridge method is used in which the balance is highly sensitive to the absorption. A special heterodyne receiver is used as a null indicator instrument.

621.317.743 : 621.372.56 **507**

A Radio-Frequency Transformer Attenuator for use with a Level Recorder.—C. G. Mayo & R. E. Jones. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 401–403.) An attenuator for operation at 10·7 Mc/s is described which can be substituted for the potentiometer of a commercial high-speed level recorder without requiring modification of the latter. A method of recording field strength is indicated using the attenuator and level recorder with a receiver having an i.f. of 10·7 Mc/s.

621.317.784.029.63 **508**

U.H.F. Meter measures Low Power Levels.—R. L. Bailey & J. B. Quirk. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 159–161.) A coaxial-line device is described for measuring power in the range 10–100 μW at frequencies up to 900 Mc/s with an insertion loss $<$ 0·8 db.

621.37/.39.001.4 **509**

Pan-climatic Testing.—G. W. A. Dummer, S. C. Schuler & J. E. Green. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 598–600.) Information compiled for the Ministry of Supply K.114 series of test schedules for Service equipment is summarized. The tests cover combinations of extreme climatic conditions and mechanical stresses. A list is given of common faults in electronic equipment as indicated by this series of tests.

621.373.4.029.64 **510**

New 7-11-kMc/s Signal Generator yields Valuable Design Hints.—A. Fong. (*Tele-Tech*, Aug. 1954, Vol. 13, No. 8, pp. 92–93..184.) An account is given of some of the problems encountered in the design of a signal generator suitable for pulse work, slotted-line work and applications requiring a sawtooth f.m. signal. The oscillator uses a Type-5721 reflex klystron with a $3\lambda/4$ coaxial-line resonator. The frequency range is covered by means of two repeller modes: the $3\frac{3}{4}$ mode for the 7–9 kMc/s range, the $4\frac{3}{4}$ mode above 9 kMc/s. A special plunger is used to suppress the $\lambda/4$ resonator mode. A waveguide operated beyond cut-off is used as output attenuator. The power-output monitor is also briefly discussed.

621.397.61.001.4 **511**

Color Test Technique for TV Broadcasters.—J. W. Wentworth. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 120–123.) Methods of testing the amplitude/frequency, phase/frequency, differential-gain and differential-phase characteristics of transmitters are outlined. Colour-bar and dot-pattern generators are described.

621.397.62.001.4 **512**

Measurements on Television Receivers: Part 5—Measurements on the Deflection System.—O. Macek. (*Arch. tech. Messen*, Sept. 1954, No. 224, pp. 205–208.) Part 4: 3634 of 1954.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

526.2 : 535.22.082.5/.7 **513**

The Geodimeter—an Electronic "Eye" for Measuring Distance.—C. E. Granqvist. (*Tele-Tech*, Sept. 1954, Vol. 13, No. 9, pp. 68–69..148.) Bergstrand's Kerr-cell method of measuring the velocity of light (3396 of 1952) is applied to the converse problem of distance measurement.

535.24 : 778 **514**

A Simple Integrating Light Meter.—W. Hartnagel. (*Z. angew. Phys.*, July 1954, Vol. 6, No. 7, pp. 310–313.) The measurement is effected by means of a photocell, the current from which periodically discharges a capacitor; the latter is automatically recharged by a relaxation oscillator which simultaneously actuates a counter.

621.316.718 : 534.85 : 621.94 **515**

Recorder-Controlled Automatic Machine Tools.—E. W. Leaver & G. R. Mounce. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 124–128.) Description of the operation of an engine lathe in which the carriage feed and cross feed are actuated by motors controlled by signals magnetically recorded on wire or tape. A sinusoidal reference oscillation is used.

621.317.39 : 61 **516**

Electrical Techniques in Medicine.—C. N. Smyth. (*Trans. Soc. Instrum. Technol.*, June 1954, Vol. 6, No. 2, pp. 84–95. Discussion, pp. 95–96.) A survey is presented of electrical instruments with particular reference to the measurement of pressure and strain. About 100 applications are classified in nine main groups and the principles of operation of several instruments, such as the ultrasonic microscope, are briefly described. 63 references.

621.383.2 : 778.37 **517**

Application of the Electron-Optical Converter for Photography of High-Speed Processes.—M. P. Vanyukov & E. V. Nilov. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1209–1218.) Application of the A.E.G. electrostatically focused three-electrode image-converter to the photography of spark discharges of duration 0·4–2 μs is discussed. Image distortion observed with photocathode illumination $> 10^6$ lux is related to the field distribution in front of the photocathode and the build-up of the space charge.

621.384.611 **518**

Alternating Gradient Focusing of Cyclotron External Beam.—E. L. Hubbard & E. L. Kelly. (*Rev. sci. Instrum.*, Aug. 1954, Vol. 25, No. 8, pp. 737–739.) Description of an arrangement comprising three alternately converging and diverging e.s. lens elements of hyperbolic cross-section for focusing the $\frac{3}{4}$-MeV external proton beam for the 20-in. Berkeley cyclotron.

621.385.833 **519**

Requirements contributing to the Design of Devices used in correcting Electron Lenses.—G. D. Archard. (*Brit. J. appl. Phys.*, Aug. 1954, Vol. 5, No. 8, pp. 294–299.) Voltage requirements and positioning tolerances are discussed.

621.385.833 **520**

Experimental Investigation of Cylindrical Magnetic Electron Lenses.—V. M. Kel'man, D. L. Kaminski & S. Ya. Yavor. (*Zh. tekh. Fiz.*, Aug. 1954, Vol. 24, No. 8, pp. 1410–1427.) Formulae derived, assuming the lens field to be practically equal to that produced by equal currents flowing in opposite directions along two parallel infinitely long wires, were tested experimentally. The calculated and measured values were in good agreement. Results for one lens and for a system of two cylindrical lenses are presented graphically and the apparatus used is briefly described.

621.385.833 **521**

The Theoretical Resolving Power of an E.S. Immersion Objective.—A. Septier. (*J. Phys. Radium*, July/Sept. 1954, Vol. 15, Nos. 7/9, pp. 573–581.) Calculations based on geometrical optics give a limiting value of the order of 30 mμ for the resolving power. This might be reduced to about 10 mμ by special grid design, but spherical aberration is then of the same order of magnitude. Calculations based on the distribution of electron density in planes adjacent to that of the Gaussian image give a theoretical limiting value of the order of 1 mμ.

621.385.833 : 537.533 **522**

Field-Emission Current Densities and Surface Field Strengths in Field-Emission Microscopes, and Methods for the Determination of the Radius and Shape of the Point, the Magnification and the Resolving Power.—M. Drechsler & E. Henkel. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, pp. 341–346.)

621.387.424 **523**

The Efficiency of Halogen-Quenched Geiger-Counters for X Rays.—D. van Zoonen. (*Appl. sci. Res.*, 1954, Vol. B4, No. 3, pp. 196–204.)

621.387.424 **524**

Small-Diameter Geiger-Müller Counters with External Cathode.—D. Blanc. (*J. Phys. Radium*, July/Sept. 1954, Vol. 15, Nos. 7/9, pp. 590–591.) Counters 6 mm in diameter, with methylal/argon filling, and having a Geiger threshold of 820 V are described.

621.398 : 621.396.65 **525**

Radiation Monitor for Atomic Explosions.—(*Tech. News Bull. nat. Bur. Stand.*, Aug. 1954, Vol. 38, No. 8, pp. 116–118.) Data on the radiation intensity and other variables in the neighbourhood of the explosion are automatically measured and transmitted by radio to a control station, where the operator is able to select one of several data stations and is also able to select the particular property on which to be informed. The v.h.f. f.m. radio link and station interrogation system are based on standard equipment including a 0·25-W portable transmitter-receiver. Repeater stations capable of handling information from ten data stations are located at positions of high elevation.

681.81 : 621.3 **526**

Electronic Musical Instruments.—W. Kwasnik. (*Elektrotech. Z., Edn B*, 21st Aug. 1954, Vol. 6, No. 8, pp. 305–312.) A historical survey from 1761 up to date includes brief descriptions of instruments, their principles of operation and circuits used. 31 references.

PROPAGATION OF WAVES

538.566 : 537.562 : 621.37 **527**

Analogues of an Ionized Medium.—R. N. Bracewell. (*Wireless Engr*, Dec. 1954, Vol. 31, No. 12, pp. 320–326.) The propagation of plane waves in ionized media can be represented by equations of the same form as those representing wave propagation in transmission lines. Equivalent circuits are presented for propagation in (*a*) free space, (*b*) an ionized medium, (*c*) an ionized medium, taking account of collisions, (*d*) the ionosphere, taking account of inhomogeneities. The analogy provides an explanation of the ability of a highly reflecting layer to transmit radiation if the medium beyond the reflecting layer satisfies certain conditions of resonance. Mechanical and waveguide analogues of the ionized medium are also mentioned.

538.566 : 551.510.535 **528**

The Propagation of Long Electric Waves round the Earth in relation to Transmission Interference and Lightning Atmospherics.—W. O. Schumann. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, pp. 346–352.) Literature on long-wave propagation is surveyed. In order to explain the 'slow-tail' phenomena of atmospherics, very low values of ionosphere conductivity must be assumed. On the other hand, in order to explain numerous observations of signals comprising multiply reflected pulses high conductivity must be assumed, and in some cases different reflection heights. Further observations and analysis are required.

621.396.11 + 551.510.53 **529**

Rocket Exploration of the Upper Atmosphere.—Boyd, Seaton & Massey. (See 424.)

621.396.11 **530**

Velocity of Radio Waves.—R. L. Smith-Rose. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 590–591.) At the 11th General Assembly of the International Scientific Radio Union in 1954 the value of 299 792 ± 2 km/s was adopted for the velocity of e.m. waves in vacuum. The circumstances leading to this decision are outlined.

621.396.11 **531**

The Extension of Sommerfeld's Formula for the Propagation of Radio Waves over a Flat Earth, to Different Conductivities of the Soil.—H. Bremmer. (*Physica*, Aug. 1954, Vol. 20, No. 8, pp. 441–460.) Propagation over a mixed terrain is discussed, starting from an integral equation of the type used by Hufford (2311 of 1952). Such an integral equation can take account of different distributions of the dielectric constant and conductivity in the region between the point source and the receiving point. The solution for the special case of two adjacent homogeneous media is identical with Clemmow's solution (3688 of 1953). Expressions derived are suitable for numerical computations. The case of three adjacent media is also investigated.

621.396.11 **532**

Ray-Path Characteristics in the Ionosphere.—G. Millington. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 235–249. Digest, *ibid.*, Part III, May 1954, Vol. 101, No. 71, pp. 193–196.) A quicker and more accurate method of making magneto-ionic calculations is presented than that previously given (778 of 1952), based on the introduction of a new parameter. Propagation in the magnetic meridian plane is studied in detail, including the phenomenon described by Poeverlein of a cusp at the ray-path apex within a certain critical angle of incidence. The theory indicates that the effect of lateral deviation on direction finding is too small to be observable except under special conditions unlikely to occur in practice.

621.396.11 : 531.510.535 **533**

Some Notes on the Absorption of Radio Waves reflected from the Ionosphere at Oblique Incidence.—W. J. G. Beynon. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 367–370.) Discussion on 1550 of 1954.

621.396.11 : 551.510.535 **534**

The Reflection and Absorption of Radio Waves in the Ionosphere.—W. R. Piggott. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 367–370.) Discussion on 1679 of 1953.

621.396.11.029.45 : 551.594.6 **535**

Theoretical Calculations of Field of Low-Frequency Electromagnetic Waves above Earth's Surface.—Ya. L. Al'pert. (*C. R. Acad. Sci. U.R.S.S.*, 1st Aug. 1954, Vol. 97, No. 4, pp. 629–632. In Russian.) The propagation of lightning atmospherics at frequencies between about 0·5 and 15 kc/s is considered. Numerical results of field-strength calculations are presented graphically using a formula relating the field strength (in mV/m) at distances greater than about 50–100 km to the frequency, the aerial current (in A), the effective aerial and ionosphere heights and the distance (all in km), and functions of the reflection coefficient and complex permittivity of the ionosphere. Infinite conductivity of the earth's surface is assumed. The variation of the amplitude and of the phase velocity with distance is also shown graphically. Results are compared with experimental results of Chapman & Matthews (419 of 1954) showing the relation between relative amplitude and frequency at distances of 500, 1 000 and 2 000 km, and those of Weekes (1491 of 1950) showing the relation between signal strength × distance and distance; the frequency used in the calculation was near 15 kc/s, that in the latter experiments 16 kc/s. Good agreement was obtained with both sets of observations, indicating that the irregular properties of the field are principally due to complex interference effects rather than to irregularities of the transmission medium.

621.396.11.029.55 : 551.510.535 **536**

Ionospheric Absorption at Vertical and Oblique Incidence.—G. McK. Allcock. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 360–367. Discussion, pp. 367–370.) Research on ionospheric absorption is briefly reviewed and an account is given of an experimental investigation made in New Zealand during 1949–1950. The relation between absorption at vertical incidence and absorption over an 800-km oblique-incidence path was studied by measurements on frequencies of 5·455 and 9·16 Mc/s respectively. The observed results differ from those predicted by Martyn's absorption theorem by an amount which is subject to a diurnal variation. Empirical formulae are derived for diurnal and seasonal variation of absorption.

621.396.11.029.64 : 535.4 **537**

The Reflection of Electromagnetic Waves from a Rough Surface.—H. Davies. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 209–214. Digest, *ibid.*, Part III, March 1954, Vol. 101, No. 70, p. 118.) A statistical method is used to investigate scattering and reflection from perfectly conducting surfaces having random irregularities which are assumed to be not so large as to shield any part of the surface from the incident radiation. The method is used to study scattering of light by a disturbed water surface and to calculate the sea clutter in radar at centimetre wavelengths; the calculated results in the latter case are compared with observations reported previously [3257 of 1947 (Davies & Macfarlane)] and the limitations of the approximation are discussed.

621.396.812.029.62 **538**

Long-Distance U.S.W. Reception.—E. A. Lauter & L. Klinker. (*NachrTech.*, June 1954, Vol. 4, No. 6, pp. 242–247, 271.) Records of field-strength measurements made at Kühlungsborn since 1951 are analysed in respect of diurnal variations of mean level, sudden changes in level, and rapid fluctuations. Data cover transmissions in the 87·5–100-Mc/s band over two 200-km land paths and one 180-km sea path, and hourly records of some 30 transmissions over distances 50–500 km. Refraction theory accounts satisfactorily for propagation over distances up to three times the optical range; partial reflections can give field strengths below the horizon only 20–30 db below the level for free-space propagation; relatively high mean field strength at great distances during unstable atmospheric conditions is ascribed to scattering processes.

621.396.812.3 **539**

Spaced-Receiver Experiments on Radio Waves of 19-km Wavelength.—J. Harwood. (*Proc. Instn elect. Engrs*, Part IV, Aug. 1954, Vol. 101, No. 7, pp. 183–186. Digest, *ibid.*, Part III, March 1954, Vol. 101, No. 70, pp. 113–115.) Signals from GBR were received at a distance of about 100 km at two spaced sites. Fading records of the wave reflected from the ionosphere indicated the presence of a randomly varying component superposed on the steady amplitude. The correlation between the records at the two receiving points was about 0·8 for a spacing of 15 km and 0·35 for a spacing of 40 km. The time variations of the random component were consistent with reflection from scattering centres in the ionosphere moving with random velocities having an r.m.s. value of about 8 m/s in the line of sight, or drifting steadily with a velocity of about 100 m/s in a direction predominantly east-west.

RECEPTION

621.376.332 : 621.396.822 540

The Statistical Properties of the Output of a Frequency Sensitive Device.—G. R. Arthur. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1185–1195.) Analysis is presented for a frequency discriminator with an input consisting of a narrow-band spectrum with random characteristics. For the case when the output is not filtered, a solution is found in which the output is given as the difference between two independent random quantities; the characteristic function method is used. For the case when the discriminator is followed by a filter, a solution is found by determining the predominant moments of the output probability density from a series expansion. This method shows that the Gaussian density is approached when the output filter has a very narrow pass band.

621.396.62 541

Ratio Squarer.—L. R. Kahn. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, p. 1704.) Analysis indicates that in order to optimize the combined output signal/noise ratio in a diversity system in which the signals are added linearly and the noise according to root mean squares, the ratio of the signal levels should be squared before combination. A block diagram of a circuit used in the U.S. Army AN/FGC-29 equipment for obtaining the ratio squarer selection curve in a two-receiver system is shown.

621.396.621 : 621.314.7 542

Transistor Circuit.—W. G. Walter & K. Walter. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, p. 595.) The circuit is given of a highly selective receiver using a single junction transistor and a Ge diode. The signal drive is on the emitter and the rectified signal is derived from a coil in the base circuit.

STATIONS AND COMMUNICATION SYSTEMS

621.376 : 621.396.822 543

Theoretical Limits for Transmission in the case of High Noise Level for Different Continuous and Coded Modulation Systems.—F. de Jager. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 675–682.) Using optimum bandwidth, the minimum power necessary for transmitting a sinusoidal signal to give a signal/noise ratio of 30–40 db at the receiver output is roughly the same for f.m., p.p.m., binary-code p.m. and delta modulation systems, the noise level in the transmission channel being such that the signal/noise ratio obtainable with s.s.b. modulation using the same power is 17–20 db. The required minimum power is a few db higher if pulses are modulated at h.f. When the transmission chain comprises many sections the necessary power per section is much higher for continuous modulation systems such as f.m. and a.m., but only a few db higher for coded systems.

621.376.5 : 621.39 544

Mean [energy] **Spectrum of a Train of Pulses of Generally Periodic and Identical Character but Displaced and Deformed in a Random Manner.**—R. Fortet. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 683–687.) General formulae are derived, particular cases having been dealt with by Macfarlane (217 of 1950). The spectrum comprises: (*a*) lines at harmonics of the theoretical pulse repetition frequency, the amplitudes being dependent on the deformation and displacement of the pulses; (*b*) a continuous spectrum dependent on both deformation and displacement; this disappears if the pulse train is undisturbed. Thus the ratio of the total energies of (*a*) and (*b*) is effectively a signal/noise ratio.

621.396.41 545

A New Frequency-Division Multiplex Radiotelegraphy System(MADFAS).—A. Niutta. (*Poste e Telecomunicazioni*, April 1954, Vol. 22, No. 4, pp. 171–178.) Description of a frequency-shift system designed for high frequency stability and low frequency-band occupancy. The signal is generated in the a.f. band and raised to radio frequency by successive modulations. A pilot frequency is transmitted for automatic control of the receiver oscillator. Tests made between Rome and Amsterdam gave satisfactory results.

621.396.712.3 546

New Unit-Construction Studio Equipment.—G. Schadwinkel. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 5/6, pp. 137–140.) Details are given of the microphone supply unit Type N52a and the adjustable band-pass filter Type W75k.

621.396.933 547

A Single-Sideband Controlled-Carrier System for Aircraft Communication.—G. W. Barnes. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 399–400.) Discussion on 2512 of 1954.

621.376 : 621.39 548

Modulation Theory. [Book Review]—H. S. Black. Publishers: Van Nostrand, New York and London, 1953, 363 pp., $8.75. (*Science*, 27th Aug. 1954, Vol. 120, No. 3113, p. 342.) The subject is considered in the light of information theory, with primary emphasis on the systems aspect of modulation. The material presented has been used in the communications development training programme of the Bell Telephone Laboratories.

SUBSIDIARY APPARATUS

621-526 549

Analysis of Systems involving Difference-Differential Equations.—T. M. Burford. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1145–1148.) A method alternative to that presented by Chu (1185 of 1954) for analysis of control systems.

621-526 : 621.372.55 550

Compensation Networks for Carrier-Frequency Servomechanisms.—P. Bonnet. (*Onde élect.*, Aug.–Oct. 1954, Vol. 34, Nos. 329–331, pp. 688–699 & 812–818.) Methods are described for determining the transfer function and for the synthesis of gain- and phase-correction networks, particularly symmetrical bridged-T and parallel-T networks.

621.311.6 : 621.396.712 551

Power Supply for Automatically Controlled Transmitters.—H. Kreutzträger. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 5/6, pp. 133–136.) Descriptions are given of the normal arrangements for taking power from the public supply and of emergency arrangements using batteries or Diesel generators.

621.314.634.3.012 552

Selenium Rectifier Instantaneous Characteristics.—G. F. Pittman, Jr. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication & Electronics*, March

1954, Vol. 73, pp. 45–49. Digest, *Elect. Engng, N.Y.*, Aug. 1954, Vol. 73, No. 8, p. 719.) Current/voltage characteristics obtained by applying a rectified sinusoidal voltage to a Se cell in the reverse direction have been recorded. A current in the forward direction flows during a large part of the cycle. A convenient equivalent circuit to explain this result comprises nonlinear capacitance and nonlinear resistance in parallel. Both resistance and capacitance decrease with increasing reverse voltage and are relatively independent of the frequency of the supply voltage over a wide range.

621.396.63 **553**

Signal-Operated Switching.—R. Selby. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 613–615.) Description of a fault-warning system operated by cessation of an audio signal and used as a programme-failure alarm. The circuit is based on a thyratron valve.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 : 621.396.65 **554**

The U.H.F. Radio-Link Equipment Type-RVG 904 for relaying Television Signals.—C. Boden. (*NachrTech.*, June 1954, Vol. 4, No. 6, pp. 267–271.) Review of the transmitter and receiver circuits and the aerial system of the equipment [3693 of 1954 (Mansfeld)], illustrating problems of design. A coaxial coupling system is used; the frequency-conversion stage at the input has a parallel-fed oscillator and push-pull i.f. output; the transmitter amplifier comprises four stages in cascade. Matching arrangements are outlined and operating characteristics are shown. Details are given of an u.h.f. discriminator connected to the aerial feeder for monitoring purposes.

621.397.26 : 621.397.62 : 535.88 **555**

Large-Screen Projection Television: Demonstration at the Palais de Chaillot of News Item televised from Tours.—R. Aubert & M. Sollima. (*Rev. gén. Élect.*, Sept. 1954, Vol. 63, No. 9, pp. 533–535.) The demonstration was presented in May 1954, to mark the occasion of the sixtieth anniversary of the École supérieure d'Électricité and of the Tours Week; it constituted the first radio relay of a televised news item by the French broadcasting organization. The existing Paris-Tours link was used in reverse. The relay stages and equipment used are indicated briefly; the pickup tube was a supericonoscope of French manufacture, and the projection system was of Schmidt type.

621.397.5 **556**

Reflections on the Future Development of Television.—F. Schröter. (*Ricerca sci.*, Aug. 1954, Vol. 24, No. 8, pp. 1613–1640. In French.) A survey of problems involved, including programme distribution, simplification of synchronizing-pulse scheme, collective reception, transmission of picture and sound on common carrier, and reduction of receiver costs. The imminence of colour television in Europe enhances the need for unifying standards. Advantages of image storage at the receiver are discussed and various methods of compressing signal bandwidth are compared.

621.397.5 : 535.623 **557**

The Electronic Colour-Television System developed by the Société nouvelle de l'Outillage R.B.V. and the Société La Radio-Industrie.—L. Kohn. (*Rev. gén. Élect.*, Sept. 1954, Vol. 63, No. 9, pp. 527–532.) Report of developments in France, where efforts have been directed to devising a system simpler than that of the N.T.S.C. Using the whole 10·4 Mc/s of the 819-line video channel, the first 8 Mc/s is shared by the red and green signals in sequence, while the blue signal is transmitted continuously in a single sideband of width 1 Mc/s on the outer side of a subcarrier at 9·4 Mc/s. For convenience, 810 lines are used instead of 819, and the red and green signals alternate in line sequence, so that the red lines of one frame are superposed exactly on the green lines of the preceding one, i.e. there is no interlacing. Pickup arrangements for colour film and for direct viewing are outlined, using three photocells and three image orthicons respectively, with optical splitting devices. Possible reception arrangements include (*a*) a three-tube projection system retaining the alternating red and green and continuous blue signals, (*b*) a single tube of chromatron type, involving sequential red, green and blue operation, and (*c*) use of an R.C.A. type three-gun colour-dot tube, which again permits operation with a continuous blue signal.

621.397.5 : 535.623 **558**

Compatible Colour-Television Systems.—É. Labin. (*Rev. gén. Élect.*, Sept. 1954, Vol. 63, No. 9, pp. 516–526.) Conditions for compatibility between monochrome and colour signals are considered and two particular systems are discussed in detail, that of the N.T.S.C. developed in the U.S.A., and that of Valensi, investigated in France. Valensi's system uses at the transmitter a special coding tube, having a screen with areas of different opacity corresponding to the 30 divisions of the colour triangle recognized by the C.I.E., to produce a single-component chrominance signal from the three signals delivered by the trichromatic camera. A bandwidth of 1·2–1·5 Mc/s is sufficient for this signal, which is placed on a subcarrier located near the edge of the video channel at a frequency which is an odd multiple of half the line frequency. At the receiver the three colour signals are recovered by a decoding system in which the received chrominance signal is applied to three formatron tubes generating appropriate output functions determined from consideration of the nature of the C.I.E. coordinates. A construction in which the three formatron tubes are combined into one is described. Reception would require a variant of the synchronized-detection system combined with use of comb-characteristic filters. It would alternatively be possible to transmit Valensi-type signals by using the first 7 Mc/s of the video channel for the luminance signal and the remaining 3 Mc/s for the chrominance signal modulated on a subcarrier, in which case synchronous detection would not be required. See also **557** above.

621.397.5 : 535.623 **559**

Colour Television—History, Present State and Future Development.—E. Schwartz. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 5/6, pp. 105–126.) The developments culminating in the N.T.S.C. frequency-interlace system are described and the possibility of adapting this system for use in Europe is discussed.

621.397.6 : 535.623 : 621.385.832 **560**

Electronic Tubes for Colour Television.—R. Juillerat. (*Rev. gén. Élect.*, Sept. 1954, Vol. 63, No. 9, pp. 507–515.) A review of the different types of tube that have been developed both for the pickup and for the display of colour-television pictures. Difficulties encountered in the design of suitable tubes, especially for reception, are having an important effect on the whole development of colour television.

621.397.61 : 535.623 **561**

Problems of Television Cameras and Camera Tubes.—L. H. Bedford. (*J. Brit. Instn Radio Engrs*, Oct. 1954, Vol. 14, No. 10, pp. 464–474.) "Questions of sensitivity and signal-to-noise ratio are discussed. While the results are of general application, the subject is developed with particular reference to the image orthicon type of camera tube. The latter, in its standard form (the 3-in. image orthicon), has a considerable sensitivity advantage compared with other types of tube. For some purposes, particularly studio use, it is desirable to exchange some of this sensitivity for other properties, such as signal/noise ratio. In this case the balance of properties can be improved by increase in target area which leads to the large (4½-in.) image orthicon. A description is given of a new camera designed around the large image orthicon with maximum exploitation of the properties of the latter. Three approaches to the colour television camera problem are described, and the repercussion of colour on sensitivity and signal/noise ratio is discussed."

621.397.61.001.4 **562**

Color Test Technique for TV Broadcasters.—Wentworth. (See 511.)

621.397.62 **563**

Flywheel Synchronizing.—W. T. Cocking. (*Wireless World*, Oct.–Dec. 1954, Vol. 60, Nos. 10–12, pp. 519–522, 557–560 & 621–624.) The effect of noise and interference on the line synchronization of television receivers is explained, and the use of balanced and unbalanced a.f.c. circuits for synchronization is described.

621.397.62 **564**

Television Safety Precautions.—E. G. Goodhew. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 591–592.) Brief discussion of considerations involved in drafting British and international standards covering precautions against the usual electrical hazards as well as tube implosion and incidental X radiation.

621.397.62 **565**

Television Intermediate Frequencies.—(*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 582–583.) A note on the considerations leading to the British Radio Equipment Manufacturers' adoption of 34·65 Mc/s as vision i.f. for television receivers. A chart is presented showing the main possible forms of interference, for local-oscillator frequency above signal frequency.

621.397.62 : 621.386.842 **566**

Solid-State Image Intensifier.—R. K. Orthuber & L. R. Ullery. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 198–201.) Reprint. See 3061 of 1954.

621.397.62.001.4 **567**

Measurements on Television Receivers: Part 5—Measurements on the Deflection System.—O. Macek. (*Arch. tech. Messen*, Sept. 1954, No. 224, pp. 205–208.) Part 4: 3634 of 1954.

621.397.621 : 621.375.232 **568**

Feedback I.F. Amplifiers for Television.—H. S. Jewitt. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, pp. 609–611.) Application of design principles described previously (1009 of 1954) to a vision i.f. amplifier with bandwidth about 3 Mc/s; stray capacitance is an important feature. Performance figures are given for an experimental amplifier for a vision i.f. of 16 Mc/s, the sound i.f. being 19·5 Mc/s; the feedback is used in this case unaccompanied by transformer coupling or stagger tuning, though it can alternatively be used to give improvement in conjunction with these other features.

621.397.621.2 : 621.373.43 **569**

Differential Width Control for Television Line Scanning Circuits.—K. G. Beauchamp. (*Electronic Engng*, Nov. 1954, Vol. 26, No. 321, pp. 476–481.) A typical receiver line-scan circuit is studied to determine ways of varying the amplitude of the sawtooth current waveform without unduly affecting the extra-high voltage. An investigation is made of the design and performance of systems using a combination of series and parallel inductance connected to the output transformer, arranged so that the total inductance across the transformer windings remains constant.

621.397.82 : 621.396.61 **570**

Sine Wave all the Way.—Blackie. (See 574.)

621.397.82.029.62 **571**

Band-III Television Interference.—R. Davidson. (*Wireless World*, Dec. 1954, Vol. 60, No. 12, p. 594.) A note suggesting that the problem is less serious than indicated by Strafford (3708 of 1954).

621.397.828.029.62 **572**

Suppression of Interference from Motor Vehicles.—W. Scholz. (*Elektrotech. Z., Edn A*, 1st Aug. 1954, Vol. 75, No. 15, pp. 504–506.) Results of measurements, presented graphically, show that 95% of cars (excluding diesel-driven vehicles) and 99% of motor-cycles produce an interference field-strength > 500 μV/m at 10 m distance at a frequency of 200 Mc/s. This was measured using a receiver with a ± 100-kc/s pass band in conjunction with a tuned dipole mounted 3 m above ground. The field-strength indication corresponding to 500 μV/m would be 50 μV/m on British or U.S.A. equipment. The use of built-in suppressors is recommended, e.g. resistors in spark plugs, as these have the advantage of being close to the source of interference and also of being inseparable from the engine component. Other suppressors are mentioned.

TRANSMISSION

621.396.61 : 621.376.4 **573**

The Circuit Development of the Ampliphase Broadcasting Transmitter.—T. H. Price. (*Proc. Instn elect. Engrs*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 391–398.) Two circuit arrangements are described for obtaining an amplitude-modulated output by differentially controlling the phase of two r.f. generators of substantially constant voltage operating with a common load; these are (*a*) the quarter-wave or constant-current ampliphase system, and (*b*) the push-pull or constant-voltage ampliphase system. Typical performance figures are quoted; these are equal to those for the usual types of transmitter circuit. Such designs are claimed to be highly economical as regards equipment and valves.

621.396.61 : 621.397.82 **574**

Sine Wave all the Way.—L. Blackie. (*Short Wave Mag.*, Aug. 1954, Vol. 12, No. 6, pp. 312–315.) A discussion of the operation and efficiency of the final r.f. amplifier in amateur transmitters indicates that little reduction of available power is caused by changing from Class-C to Class-B, Class-AB2, or even Class-AB1 operation, while the corresponding reduction of harmonic output, and hence of interference with television, is considerable.

621.396.61 : 621.398 **575**

Pulse Transmitter for Rocket Research.—D. G. Mazur. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 164–167.) The 15-channel AN/DKT transmitter installed in Aerobee rockets is described. The normal sampling rate in each channel is 312·5 per sec; the input range is 0–5 V, the r.f. pulse width is 3 μs, the frequency 227 Mc/s, the peak power output 10 W and the channel deflection range 150 μs. Provision can be made for a higher sampling rate in one channel by disabling three others.

VALVES AND THERMIONICS

621.314.63 + 621.314.7] : 537.311.33 **576**

Semiconductors.—(*Elect. Rev., Lond.*, 27th Aug. 1954, Vol. 155, No. 9, pp. 307–311.) An account of work in progress at the new G.E.C. Wembley laboratories on the development of crystal valves.

621.314.63 : 621.318.57 **577**

Transient Response of a *p-n* Junction.—B. Lax & S. F. Neustadter. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1148–1154.) Calculations are made of the diode current and the voltage across the junction over a period after reversing the applied voltage; typical values are assumed for the diode parameters. Results are shown graphically for various values of included series resistance, and are compared with those obtained by Kingston (2539 of 1954).

621.314.632 : 537.312.9 **578**

Influence of Mechanical Pressure on Barrier Height in Galena Rectifiers.—J. N. Das & V. G. Bhide. (*Curr. Sci.*, June 1954, Vol. 23, No. 6, pp. 185–186.) Measurements show that the barrier height of the galena/Pt-whisker contact rises from 1·275 to 1·830 and then falls to 0·320 V while the spread resistance falls from 82·10 to 15·61 and then rises to 67·55 Ω for pressures of 30, 110, and 150 g weight, using a whisker of radius 0·008 cm at the point of contact. Similar results were obtained with Al and C whiskers.

621.314.7 **579**

Theory of Diffusion-Type and Drift-Type Transistors: Part 2—Frequency Characteristics.—H. Krömer. (*Arch. elekt. Übertragung*, Aug. 1954, Vol. 8, No. 8, pp. 363–369.) The quadripole admittances of a junction transistor (part 1: 3389 of 1954) taking account of the boundary-layer capacitances are dependent on frequency; a limiting frequency is thus introduced which is dependent on the matching conditions. The inherent frequency limit set by alpha cut-off is higher for the drift type than the diffusion type, in the case of Ge by a factor of 8. A detailed analysis is given for the case of purely ohmic matching. Performances are compared under different operating conditions. In practice better use can be made of the inherent cut-off frequency in the drift type.

621.314.7 : 001.4 **580**

Nomenclature of Transistor Parameters.—H. Mette. (*Funk u. Ton*, Aug. 1954, Vol. 8, No. 8, pp. 420–421.) A list is given of recommended German equivalents of English transistor terms.

621.314.7 : 537.311.33 **581**

Transistor Electronics: Imperfections, Unipolar and Analog Transistors: Parts 2 & 3.—W. Shockley. (*Proc. Instn Radio Engrs, Aust.*, Aug. & Sept. 1954, Vol. 15, Nos. 8 & 9, pp. 194–201 & 228–234.) Reprint, see 746 of 1953. Part 1: 3600 of 1954.

621.314.7 : 621.317.3 **582**

Stability Considerations in the Parameter Measurements of V.H.F. Point-Contact Transistors.—Thomas. (See 491.)

621.314.7 : 621.372.5 **583**

Design Considerations of Junction Transistors at Higher Frequencies.—H. Statz, E. A. Guillemin & R. A. Pucel. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1620–1628.) An accurate equivalent network for the junction transistor is developed based on a solution of the diffusion equation. The relation between gain and frequency is calculated and the upper limiting frequency for obtaining power gain is determined; from these results it is possible to determine the proper values of collector capacitance and base resistance in order to make full use of obtainable base width. Use of the formulae in the design of transistors to have a prescribed upper limiting frequency is illustrated by numerical examples.

621.383.2 **584**

Increased Light Sensitivity from Standard Gas Phototubes.—E. O. Johnson. (*Rev. sci. Instrum.*, Aug. 1954, Vol. 25, No. 8, pp. 839–840.) A circuit is described by means of which current amplification as high as 10^8 can be obtained with a commercial photocell without producing instability. The mechanism involves secondary emission at the photocathode due to bombardment by ions produced by the photoelectrons. The current build-up is terminated periodically by firing a thyratron.

621.383.2 **585**

The Behaviour of Gas-Filled Photocells operating in the Region of Self-Maintained Discharge.—W. Kluge & A. Schulz. (*Z. angew. Phys.*, Aug. 1954, Vol. 6, No. 8, pp. 364–370.) It was shown previously [3264 of 1953 (Kluge)] that self-maintained discharge currents in gas-filled photocells can be controlled by illumination of the cathode. An investigation is made of the upper limit which the discharge current can attain without causing structural modifications of the composite cathode. Reversible fatigue effects due to bombardment by positive ions are observed; these effects are very small with potassium hydride cathodes, hence reproducible values of photocurrent can be obtained.

621.385.004.15 **586**

Developments in Trustworthy-Valve Techniques.—E. G. Rowe & P. Welch. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 172–188.) Special tests for reliability are discussed and a complete testing procedure is indicated. Designing for reliability is considered as a problem distinct from that of making ordinary commercial valves more robust. See also 1776 of 1952 (Rowe).

621.385.029.6 **587**

Measurement of the Most Important Parameters of Helix-Type Travelling-Wave Valves for Amplication and Efficiency Calculations.—W. Klein. (*Arch. elekt. Übertragung*, Sept. 1954, Vol. 8, No. 9, pp. 404–410.) Methods are described for determining the required parameters from measurements on completed prototype valves. The results are useful for assessing the accuracy of calculated characteristics. Cases of special interest are (*a*) power valves with relatively large difference between beam velocity and phase velocity on the helix, and (*b*) valves in which the helix characteristics are appreciably modified by the dielectric supports.

621.385.029.62/.63 : 621.396.822 **588**

Minimum Noise Figure of Traveling-Wave Tubes with Uniform Helices.—J. R. Pierce & W. E. Danielson. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1163–1165.) An expression for the minimum noise figure is derived using a theorem presented by Pierce (304 of January) in conjunction with analysis developed by

Watkins (1470 of 1952). Assuming reasonable values for the valve parameters, the value of 6 db is obtained for the minimum noise figure.

621.385.029.63/.64 **589**

Helix-Coupled Traveling-Wave Tubes.—P. D. Lacy. (*Electronics*, Nov. 1954, Vol. 27, No. 11, pp. 132–135.) Two amplifier valves with coupling helices outside the vacuum envelope are described. Both operate over the range 2–4 kMc/s. One has a gain of 35 db, output 20 mW and noise figure of the order of 20 db; the other has a gain of 30 db, output 1 W and noise figure < 30 db. The coupling mechanism is that of spatial beating [30 of 1950 (Krasnushkin & Khokhlov)].

621.385.029.63/.64 **590**

A Wide-Band Voltage-Tunable Oscillator.—J. W. Sullivan. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1658–1665.) An experimental backward-wave valve has a bifilar helix in which matching is facilitated by forming one winding as a thread on a rod and the other as a wire insulated from the rod; the structure is essentially a coaxial line wound into a helix. Oscillations were obtained with frequency ranging from 2·6 to 13·3 kMc/s as the beam voltage was increased from 40 V to 3 kV, using appropriate magnetic focusing. Power outputs of 5–50 mW were obtained.

621.385.029.63/.64 **591**

Traveling-Wave Amplifiers and Backward-Wave Oscillators.—M. Muller. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1651–1658.) Analysis is presented in a unified form for the travelling-wave valve, the magnetron amplifier and the corresponding backward-wave oscillators. Formulae are derived for amplifier gain, oscillator starting current and tuning parameters.

621.385.029.63/.64 **592**

Rippled Wall and Rippled Stream Amplifiers.—C. K. Birdsall. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1628–1636.) Velocity-modulation valves are discussed having space-periodic variations of diameter of drift tube or beam or both. The periodic length is a quarter of the plasma wavelength. Gain is produced by reinforcing the simple harmonic motion of the electrons in the beam; formulae are derived giving its value for various cases, including the use of velocity jumps. Design curves are presented. An experimental rippled-wall valve for the frequency range 1–4 kMc/s is described. See also 2498 of 1953 (Birdsall & Whinnery).

621.385.029.63/.64 **593**

Power Flow and Equivalent Circuits of Travelling-Wave Tubes.—C. C. Wang; J. R. Pierce; P. K. Tien. (*Proc. Inst. Radio Engrs*, Nov. 1954, Vol. 42, No. 11, pp. 1701–1703.)

621.385.029.63/.64 **594**

A Computational Contribution to the Linear Theory of the Travelling-Wave Valve with Low Gain.—D. Weber. (*Arch. elekt. Übertragung*, Aug. 1954, Vol. 8, No. 8, pp. 341–345.) For predicting low-gain operation the initial amplitude and phase of all three r.f. components must be known. These are calculated neglecting attenuation of the delay line and space-charge forces. A table of numerical values of characteristic parameters is given including a correction to those published earlier [3754 of 1953 (Schnitger & Weber)]. By means of a graphical method outlined initial conditions can be determined with sufficient accuracy in many cases without an exact construction. The results also apply to the carcinotron.

621.385.032.216 **595**

Cathode Parasitic Impedance.—M. Berthaud. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 663–673.) Detailed discussion giving results of measurements made on commercial valves at different cathode temperatures and of investigations of the formation of interface layers. The indications are that the whole of the cathode contributes to the increased impedance. Summarized version abstracted in 1620 of 1954.

621.385.032.216 **596**

Studies of the Interface Layer in Oxide Cathodes.—L. S. Nergaard & R. M. Matheson. (*RCA Rev.*, Sept. 1954, Vol. 15, No. 3, pp. 335–361.) The complex nature of the interface layer is discussed and an experimental investigation is reported of the interface behaviour of $2BaO.SiO_2$ which is formed by reaction between the BaO of the coating and Si diffusing out of the Ni base. No definite conclusions are drawn. Measurements of interface resistance should be made at normal-operation cathode current, otherwise the effect of the valve's previous history may be obscured.

621.385.032.216 **597**

Thermionic Emission and Electron Diffraction from Thin Films of Barium Oxide.—P. N. Russell & A. S. Eisenstein. (*J. appl. Phys.*, Aug. 1954, Vol. 25, No. 8, pp. 954–961.) The structure of and thermionic emission from evaporated BaO films on a Ni base were examined simultaneously, using a specially developed sealed-off electron-diffraction tube with fluorescent screen. The thermionic activity increased with film thickness up to about 20 monolayers and then remained constant up to 50 monolayers. The effect of heat treatment was examined. The emission density is comparable to that for sprayed oxide coatings, which are much thicker; the significance of this in relation to the emission mechanism is discussed.

621.385.032.216 : 621.317.331 **598**

Sensitive Apparatus for the Measurement of Cathode Parasitic Resistance.—P. Sevin. (*Onde élect.*, Aug./Sept. 1954, Vol. 34, Nos. 329/330, pp. 673–674.) Voltages at 6 Mc/s and 10 kc/s are modulated in phase quadrature by a 200-c/s signal and applied simultaneously to the valve grid. A resistance across a 6-Mc/s rejector circuit in the cathode lead is adjusted until modulation in the anode circuit is suppressed. Using an amplifier with a voltage gain of 10^5, internal resistance below $5\,\Omega$ in the cathode can be detected.

621.385.032.216 : 621.396.822 **599**

Noise Mechanisms in Oxide-Coated Cathodes.—A. van der Ziel. (*Physica*, June 1954, Vol. 20, No. 6, pp. 327–336.) Various explanations of flicker noise in valves are reviewed. Schottky's emission-centre theory gives best agreement with observations in the case of W, Th-W and L-type cathodes. For oxide-coated cathodes, calculations based on Nergaard's concept of a depletion layer (1528 of 1953) give values of noise of the same order of magnitude as the observed values.

621.385.5 : 621.375.2.024 **600**

"Starved Amplifiers".—Kaufer. (See 385.)

621.385.832 **601**

Operation of C.R.T. Storage Devices.—S. Winkler & S. Nozick. (*Electronics*, Oct. 1954, Vol. 27, No. 10, pp. 184–187.) Types suitable for different applications are listed, with notes useful for design purposes. Limitations are indicated.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.121.2 : 621.395.61 **602**

Theory of the Effect of a Thin Air Film on the Vibrations of a Stretched Circular Membrane.—D. H. Robey. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 740–745.) Analysis generally applicable to conditions in capacitor microphones is presented. Application of the results to the case of a particular miniature microphone with titanium diaphragm shows that the effective stiffness at 20 kc/s is 15 times that at 5 c/s.

534.132 **603**

Radial Vibrations of Thick-Walled Hollow Cylinders.—J. A. McFadden. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 714–715.) Approximate formulae are given for the natural wavelengths.

534.213.4 **604**

The Propagation of Elastic Waves in Thin-Walled Cylindrical Shells.—M. C. Junger & F. J. Rosato. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 709–713.) Analysis indicates that there are two possible modes of propagation in the axial direction; at high frequencies the one corresponds to flexural waves and the other to longitudinal waves. The dispersion curves are in good agreement with published experimental results. The results are relevant to investigations of cylindrical $BaTiO_3$ transducers and to the problem of sound insulation by lightweight partitions.

534.213.4 : 534.6 **605**

Propagation of Sound in Narrow Tubes.—H. W. Helberg. (*Akust. Beihefte*, 1954, No. 2, pp. 578–586.) Theory is developed yielding the formulae of Rayleigh and Kirchhoff as limiting cases. The accuracy of Kirchhoff's expression for the attenuation is improved by addition of a constant. Using a tube of cross-section 1·03 × 19·4 mm with suspended particles as indicator, measurements were made of attenuation, sound velocity, and transverse distribution of particle velocity; the results give considerable support to the theory.

534.213.4 : 534.833.4 **606**

Propagation of Sound over Single Absorptive Strips in Ducts.—J. E. Young. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 804–818.) A method is developed for predicting the absorptive effect of the strip, with accuracy sufficient for practical purposes, by a combination of approximations involving assumptions about the potential distribution at the surface of the strip. In the case of resonant absorbers with low dissipation the attenuation can be calculated simply and accurately for strips of sufficient length, found experimentally to be about four times the duct diameter. Predictions can be made for porous strips in the same length range if the appropriate phase parameter is determined.

534.23 **607**

An Exact Method for determining the Directivity Index of a General Three-Dimensional Array.—E. Rhian. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 704–706.)

534.26 **608**

Diffraction of an Acoustical Wave Obliquely Incident upon a Circular Disk.—H. S. Heaps. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 707–708.) Calculated values of the sound pressure behind the disk with an obliquely incident wave are compared with those with a normally incident wave.

534.61 : 621.395.61 **609**

Ceramic Probe Microphones.—E. Ackerman & W. Holak. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 857–861.) Report of a study of two types of microphone used for measuring intense sound fields at frequencies in the range 6–100 kc/s. The sensitive element is a $BaTiO_3$ cylinder $\frac{1}{16}$ in. in length and in overall diameter. Calibration procedures are described.

534.612.4 **610**

Pressure Calibration of Condenser Microphones above 10 000 c/s.—B. D. Simmons & F. Biagi. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 693–695.) "A 'plane wave' acoustic coupler and an electrical admittance method are described for the pressure calibration of condenser microphones in the ultrasonic frequency range."

534.614-8 **611**

Rapid-Indication Ultrasonic Interferometer.—L. Bergmann. (*Akust. Beihefte*, 1954, No. 2, pp. 591–593.) Measurements of the velocity of sound in gases and liquids are made quickly using a decade counter tube to count the number of maxima traversed as the interferometer reflector is shifted through a given distance.

534.62 + 621.317.3.029.63 **612**

Construction of a Reflection-Free Room for Sound Waves and Decimetre Electrical Waves.—G. W. Epprecht, G. Kurtze & A. Lauber. (*Akust. Beihefte*, 1954, No. 2, pp. 567–577.) Description of a room constructed at Berne, having inner dimensions 5 × 4·4 × 2·6 m, lining depth 60 cm and acoustic cut-off frequency 120 c/s. To make the lining absorbent for e.m. waves, steel wool is used rather than the graphite used in the anechoic chamber at Göttingen [942 of 1954 (Meyer et al.)]. The floor is netting made of perlon cables of diameter 4 mm.

534.785 **613**

Some Factors affecting Multichannel Listening.—J. P. Egan, E. C. Carterette & E. J. Thwing. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 774–782.) An experimental investigation is reported of the intelligibility of a wanted speech message in the presence of an unwanted speech message. Use of a high-pass filter in either of the two channels improved intelligibility. The advantages of dichotic presentation were demonstrated. Masking of speech by noise was also investigated.

534.832 : 534.121.1 **614**

Sound Radiation from a Wall excited to Flexural Vibrations.—W. Westphal. (*Akust. Beihefte*, 1954, No. 2, pp. 603–610.) By using the 'radiation coefficient', whose value can be found approximately from theory developed by Gösele (949 of 1954), an estimate can be made of the sound energy radiated from a plate from measurements of the amplitude of flexural vibrations. A determination of the lateral transmission in building acoustics can hence be made.

534.833.4 **615**

The Multiple-Panel Sound Absorber.—E. C. H. Becker. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 798–803.) Equivalent-circuit analysis is presented for multiple-panel absorbers; increasing the number of elements increases the absorption bandwidth, particularly at low frequencies. An example is described of a particular construction giving satisfactory results.

534.84 **616**

Review of Architectural Acoustics during the Past Twenty-Five Years.—V. O. Knudsen. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 646–650.)

534.84 **617**

Definition and Diffusion in Rooms.—E. Meyer. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 630–636.) The importance of diffusivity as a criterion of acoustic quality is indicated in an account of architectural acoustics research at Göttingen. The product of definition and diffusivity may prove to be a useful figure of merit.

534.84 **618**

The Statistical Parameters of the Frequency Response Curves of Large Rooms.—M. Schröder. (*Akust. Beihefte*, 1954, No. 2, pp. 594–600.) Frequency response curves are obtained using a variable-pure-tone generator and a microphone at different pairs of separated points in the room. Calculations are made of the r.m.s. response fluctuation, the mean height of the peaks, the mean spacing of the zero points (intersections of response curve with mean level), the mean spacing of the peaks, the mean phase rotation per c/s, and the 'frequency irregularity'.

534.84 **619**

The Frequency Dependence of the Sound Pressure in Rooms.—H. Kuttruff & R. Thiele. (*Akust. Beihefte*, 1954, No. 2, pp. 614–617.) Measurements made on 19 rooms under different conditions are reported, using stationary excitation. Analysis of the frequency response curves over the range 70–4 000 c/s indicates that the mean difference of level between successive maxima and minima amounts to 9–10 db, irrespective of room volume or reverberation time. The total number of maxima is proportional to mean reverberation time, with a mean fluctuation of 10%. The 'frequency irregularity' is thus also proportional to reverberation time.

534.84 **620**

Experiments for the Determination of Optimum Reverberation Time for Large Music Studios.—W. Kuhl. (*Akust. Beihefte*, 1954, No. 2, pp. 618–634.) Estimates of optimum reverberation time were made on the basis of over 13 000 individual judgments on different records of three pieces of orchestral music recorded in a number of different rooms with volumes ranging from 2 000 to 14 000 m³. Reverberation-time/frequency curves derived from the records are presented, together with the frequency analysis of a typical loud chord for each record. Values of reverberation time judged to be optimum for the different types of music are quoted; these values do not depend on studio volume. For an occupied studio the best compromise is 1·7 sec; for a small unoccupied studio the best value is considerably higher.

534.84 **621**

Electroacoustic Characteristics of the Palais des Festivals at Cannes.—C. Soulé. (*Rev. Son*, Sept./Oct. 1954, No. 18, pp. 251–252.) The measured reverberation-time/frequency characteristic is in general agreement with the theoretical curve for an auditorium of volume 2 000 m³; the theoretical curve corresponding to the actual volume of 10 000 m³ lies rather higher. This slight deadening was achieved deliberately by acoustic treatment. Curves of recorded level/frequency in stalls and circle are also given.

534.84 : 621.395.623.8 **622**

Sound Systems for Large Auditoriums.—L. L. Beranek. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 661–675.) This comprehensive review includes consideration of auditorium acoustics, loudspeaker types and arrangements, and psycho-acoustic factors. Reference is made to the sound systems in the University City Hall, Caracas, Venezuela, in the United Nations Headquarters Hall, New York, in a municipal theatre, and in the Holy Cross Cathedral.

534.845 **623**

Advances since 1929 in Methods of Testing Acoustical Performance of Acoustical Materials.—F. G. Tyzzer & H. A. Leedy. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 651–656.)

534.845 **624**

Possibilities of Error in Measurements of Sound Insulation at Low Frequencies: Part 1.—W. Kuhl. (*Akust. Beihefte*, 1954, No. 2, pp. 611–614.) Measurements subsequent to those reported by Becker et al. (311 of

1953) indicate that the methods used may involve appreciable errors at low frequencies, due to (*a*) standing waves, (*b*) insufficient size of specimen, (*c*) natural resonances of the test rooms and (*d*) incorrect determination of the absorption surface in the receiving space.

534.845 **625**

On Sound Absorption by Cylindrical Diffusers.—G. Parolini. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 795–797. *Ricerca sci.*, July 1954, Vol. 24, No. 7, pp. 1465–1470.) "Measurements were made on the acoustic absorption of plywood cylindrical diffusers coated with porous materials, such as glass wool. High absorption was obtained even in the low frequency range, owing to the resonance of the cylindrical plywood frame, and to sound scattering. The experimental values have been found in good agreement with those computed according to Cook and Chrzanowsky's theory."

534.845 **626**

A Nomogram for Simplification of the Determination of Sound Absorption by the Reverberation-Chamber Method.—W. Händler & G. Venzke. (*Akust. Beihefte*, 1954, No. 2, pp. 587–590.) A nomogram based on the Sabine formula is presented and the method of use explained.

534.845.1 **627**

Comparative Measurements of the Absorption of Sound by Absorptive Materials, using the Tube and Reverberation-Chamber Methods.—G. Kurtze & A. Lauber. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st July 1954, Vol. 32, No. 7, pp. 249–253. In German.) Report of measurements made on some commonly used porous materials, with the object of determining the range of validity of the cosine law of variation of absorption coefficient with angle of incidence, and hence determining the degree of reliance to be placed on results obtained by the simple tube method. Large discrepancies observed between the results by the two methods are probably due to velocity components parallel to the boundary surface and not taken into account in the calculations.

534.845.1 **628**

Resonance Reverberation Method for Sound Absorption Measurements.—J. Karpovich. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 819–823.) The method described is suitable for measurements on liquids at frequencies from about 20 kc/s to over 600 kc/s. Sound absorption coefficients of 44 liquids are tabulated. Application of the method to measurements on solids is mentioned.

534.85 **629**

A Review of Twenty-Five Years of Sound Reproduction.—H. F. Olson. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 637–643.)

534.85 **630**

Noise Level and Mechanical Stresses in Plastic Sound Records.—E. A. Keller. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 685–687.) "Residual mechanical stresses in press-polished plastic film material used for the embossing type sound recording are in many cases responsible for relatively high noise levels. Results of noise measurements of different plastic materials on a 400 grooves per inch recorder are presented. The relation between optically observed stresses and recorded noise level is given. Practical consequences are discussed."

534.85 **631**

Contribution to Analysis of Recording Process in H.F. Magnetic Recorders.—O. Schmidbauer. (*Funk u. Ton*, July 1954, Vol. 8, No. 7, pp. 341–360.) The h.f. bias recording method is analysed and the influence of tape type, tape speed, width of recording-head gap and other parameters is discussed. A brief comparison with experimental results is made and reasons for discrepancies are noted. The possibility of indicating the quality of commercial tapes by a code is examined.

534.85 : 621.395.625 **632**

Fluctuations of Pitch of Recorded Sounds and Determination of Permissible Limits for Broadcasting.—P. H. Werner. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Sept. 1954, Vol. 32, No. 9, pp. 360–362. In French.) Methods of measurement of wow and flutter are outlined. Subjective tests have been made of the threshold of audibility for these two effects, using sounds produced by violin, piano and organ, recorded on magnetic tape. Frequency variations of 4% were perceived by highly sensitive listeners.

621.395.61/.62 **633**

Loudspeakers and Microphones.—L. L. Beranek. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 618–629.) Illustrated survey of developments from 1915 to date.

621.395.61 **634**

Unidirectional Microphone utilizing a Variable Distance between the Front and Back of the Diaphragm.—A. M. Wiggins. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 687–692.) A gradient microphone is described in which the force acting on the diaphragm is made frequency independent by providing two frequency-selective sound inlets at the back of the diaphragm so that the distance between the front and back inlets is greater for the lower frequencies. Under these conditions the sound-responsive element can be constructed as for a pressure microphone.

AERIALS AND TRANSMISSION LINES

621.372.2 **635**

The Elliptic Surface Wave.—A. E. Karbowiak. (*Brit. J. appl. Phys.*, Sept. 1954, Vol. 5, No. 9, pp. 328–335.) Formulae are derived for E-mode propagation on the surface of an elliptic cylinder; in this mode the field decays monotonically as the radial distance in the transverse plane increases. The relation between this case and that of the surface-wave line with circular cross-section is examined; the performance of the latter is shown to be substantially unaffected by slight deformation. Particular types of elliptical guide discussed include (*a*) the dielectric-coated conducting rod, (*b*) the rod with rectangular corrugations, (*c*) the homogeneous metal rod, and (*d*) the dielectric rod.

621.372.2.029.6 **636**

High-Frequency Phenomena.—W. A. Tripp. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, pp. 19–25.) It is shown that the introduction of e.m. field analysis is not essential for dealing with h.f. phenomena, which can be discussed satisfactorily in terms of current and voltage in the same way as l.f. phenomena; these concepts are applied to examination of the operation of transmission lines, including waveguides.

621.372.8 **637**

Propagation of Electromagnetic Waves in Cylindrical Waveguides with Imperfectly Conducting Walls.—V. M. Papadopoulos. (*Quart. J. Mech. appl.*

Math., Sept. 1954, Vol. 7, Part 3, pp. 326–334.) Calculations are made by a perturbation method, using approximate boundary conditions. The imperfectly conducting walls have the effect of removing a particular type of degeneracy occurring in the ideal guide, in which definite linear combinations of E and H modes are propagated with definite propagation constants; this type of degeneracy occurs in rectangular guides. It follows that the power-loss method of calculating the attenuation constant, which assumes pure E or H mode propagation, is not correct in these cases. The perturbation method gives not only the attenuation constant for each combination of modes, but also the value of the phase velocity, and the corresponding field components.

621.372.8 **638**

An Approximate Method for the Calculation of Propagation Constants for Inhomogeneously Filled Wave-Guides.—L. G. Chambers. (*Quart. J. Mech. appl. Math.*, Sept. 1954, Vol. 7, Part 3, pp. 299–316.) A variational method is developed which is applicable to waves whose field components are given in terms of one scalar potential, for cases where the electrical constants vary across the waveguide but not along it. The conditions for the existence of pure TE or pure TM waves in such a guide are considered.

621.372.8 **639**

Two-Section Transmission-Line Transformer.—M. S. Wheeler. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, pp. 15–18.) Analysis is presented for a waveguide-type impedance transformer convenient for coupling a magnetron to a standard waveguide and comprising two sections of different transverse dimensions. The cases of equal-length and nearly-equal-length sections are treated.

621.372.8 : 621.317.333.6 **640**

Electrical Breakdown in Waveguides at 3 000 Mc/s.—J. W. Sutherland. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 538–540.) Development of methods for testing high-power waveguides is described. The power-handling capacity can be improved by using other gases, notably 'arcton 6' in place of air.

621.372.8 : 621.39 **641**

Waveguide as a Communication Medium.—S. E. Miller. (*Bell Syst. tech. J.*, Nov. 1954, Vol. 33, No. 6, pp. 1209–1265.) The circular-electric mode is particularly advantageous for long-distance communication, since the attenuation coefficient for this mode decreases as the carrier frequency increases; the theoretical value is 2 db/mile for round guide of diameter 2 in., for frequencies around 50 kMc/s. Scale-model experiments using guide of internal diameter 4·73 in. and a frequency of 9 kMc/s are reported. Under favourable conditions the observed losses are within 25% of the theoretical values; the discrepancy is attributed partly to guide roughness and partly to mode conversion at irregularities along the guide. Distortion and crosstalk due to undesired modes can be reduced by means of mode filters; constructions providing continuous filtering are described. A suitable structure comprises a helix or series of metal rings supported in a lossy housing. Problems associated with bends in the guide are examined. Base bandwidths of the order of 500 Mc/s should be possible, using p.c.m. Regeneration would probably be required at the repeaters; the spacing between repeaters should be about 25 miles.

621.396.67 **642**

On Isotropic Antennas.—H. F. Mathis. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, p. 1810.) Addendum to 37 of 1952.

621.396.67.012.12 **643**

Radiation from a Point Dipole located at the Tip of a Prolate Spheroid.—E. C. Hatcher, Jr, & A. Leitner. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1250–1253.) Calculations are made of the radiation patterns for spheroidal conductors of various thicknesses, with major axes equal to λ/π, $2\lambda/\pi$ and $3\lambda/\pi$.

621.396.67.029.62 **644**

Internally Accessible Tubular Masts as Supports for U.S.W. and Television Aerials.—W. Berndt. (*Funk u. Ton*, June & Sept. 1954, Vol. 8, Nos. 6 & 9, pp. 288–294 & 481–489.) Mechanical construction features of support masts for use with aerials for bands I–IV are described. Slot-aerial masts are also discussed and the radiation characteristics of various systems are presented graphically. The account deals mainly with modern German practice.

621.396.674.3 **645**

Aerials for U.S.W. Broadcasting and Television.—W. Stöhr. (*Frequenz*, Aug. 1954, Vol. 8, No. 8, pp. 240–248.) The application of dipole units for directional and omnidirectional transmissions is illustrated in descriptions of three particular systems: (*a*) a v.h.f. Yagi with relative bandwidth 1·15 : 1; (*b*) a band-III television broadcasting array consisting of stacked groups of four coupled full-wave dipoles, relative bandwidth 1·5 : 1; (*c*) a v.h.f. broadcast array built up of units comprising two full-wave dipoles arranged with their two halves at right angles so as to form a square, fitting readily around or within a mast and secured to it at the voltage nodes. Aerial systems at Langenberg and Bogota and those of the Milan-Rome television link are described. Results of an investigation of the effects of ice formation on exposed aerials are noted.

621.396.676.029.62 **646**

Homing Aerials for Aircraft.—S. Zisler & G. Dubost. (*Ann. Télécommun.*, Sept. 1954, Vol. 9, No. 9, pp. 226–236.) V.h.f. systems comprising identical parallel cylindrical aerials are discussed. General relations are derived for a quadripole arrangement. Calculations are made of optimum aerial length for homing, and of the ratio between the aerial currents; these calculations are based on defining limits for the form of the radiation pattern. Factors taken into account include aerial sensitivity, represented by the variation of the radiation with direction; precision of indication of the axis, which depends on the symmetry of the system; and the need to avoid spurious indications corresponding to equality of the diagrams for directions other than the true axis.

AUTOMATIC COMPUTERS

681.142 **647**

DYSEAC—the New N.B.S. Electronic Computer.—(*Tech. News Bull. nat. Bur. Stand.*, Sept. 1954, Vol. 38, No. 9, pp. 134–141.) See 39 of 1954 (Elbourn & Witt) and 2320 of 1954 (Leiner & Alexander).

681.142 **648**

The Effect of Interpretive Techniques on Functional Design of Computers.—T. Pearcey, G. W. Hill & R. D. Ryan. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 505–519.) Analysis of the programmes for a number of computations performed by the C.S.I.R.O. Mark I computer indicates the feasibility of designing an adaptable and reliable computer having only a relatively small amount of rapid-access erasable store and a larger amount of rapid-access non-erasable store in which would be held all interpretation routines, function blocks, etc. The operator would require no knowledge of the actual machine code, but would place his hyper-programmes and data into a slow-speed backing store.

681.142 **649**

Programme Design for the C.S.I.R.O. Mark I Computer: Part 3—Adaptation of Routines for Elaborate Arithmetical Operations.—T. Pearcey & G. W. Hill. (*Aust. J. Phys.*, Sept. **1954**, Vol. **7**, No. 3, pp. 485–504.) Discussion of the extension of the library routine system to deal with floating point, multiple precision and complex arithmetic and certain combinations of these. The 'interpretive' method of programme organization [1655 of 1952 (Wilkes et al.)] is used. Part 2: 641 of 1954.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.7 : [621.37 + 621.396.621 **650**

Some Transistor Circuits.—A. J. W. M. van Overbeek. (*Tijdschr. ned. Radiogenoot.*, Sept. **1954**, Vol. **19**, No. 5, pp. 231–260.) The characteristics of junction transistors are discussed; at frequencies of 1–10 Mc/s the equivalent circuit is already as complicated as that of a thermionic valve at frequencies a hundred times higher. Particular circuits examined include one for a medium-wave broadcast receiver in which the selectivity is automatically increased as the signal strength decreases. It is pointed out that for a peak output power of e.g. 250 mW the consumption is 150–200 mW. Nonlinear distortion in transistors is compared with the corresponding effect in thermionic valves. The upper frequency limit set by cut-off of current amplification is considered in relation to trigger circuits. A circuit including a *p-n-p* and an *n-p-n* transistor is shown which has properties resembling those of a gas-filled valve with adjustable ignition voltage, short ignition time, very low discharge voltage drop and low discharge noise.

621.316.722.4 : 537.226 **651**

Dielectric Potentiometers.—G. E. Pihl. (*Proc. Inst. Radio Engrs*, Dec. **1954**, Vol. **42**, No. 12, pp. 1758–1761.) A voltage divider is described comprising a movable electrode and a system of fixed electrodes all immersed in a lossy liquid dielectric, so that the paths between the electrodes are both resistive and capacitive. The arrangement is suitable for wide-band operation (e.g. 20 c/s–1 Mc/s), since the product of the equivalent parallel resistance and capacitance is a constant depending only on the nature of the dielectric. Various practical embodiments are described. Desirable characteristics for the dielectric are indicated.

621.316.86 : 621.396.822 **652**

Current Noise in Carbon-Film Resistors.—K. E. Doering. (*Funk u. Ton*, July & Aug. **1954**, Vol. **8**, Nos. 7 & 8, pp. 378–385 & 422–429.) An experimental investigation at audio frequencies is reported. The results are consistent with an empirical formula according to which the current-noise voltage varies approximately directly with current. In a few specimens the noise was found to depend on the direction of current. 45 references.

621.316.89 **653**

The Resistivity of "Composition" Resistors at Radio Frequencies.—U. Tiberio. (*Proc. Inst. Radio Engrs*, Dec. **1954**, Vol. **42**, No. 12, pp. 1812–1813.) Continuation of the previous discussion (654 of 1954) of the mechanism causing the drop of resistance of composition resistors at h.f. Experimentally obtained resistance/frequency curves are presented for resistors comprising (*a*) a cylindrical column of an aqueous solution of sodium chloride, (*b*) a cylindrical column of an aqueous solution of copper sulphate, and (*c*) a cylindrical column of carbon/resin composition. The resistance of type (*a*) is practically constant at frequencies up to 100 Mc/s, while that of types (*b*) and (*c*) drops considerably. The drop in the resistance of the composition resistor is ascribed partly to the 'resistivity factor', and partly to the 'external capacitance factor'. It is suggested that a frequency-independent resistor could be obtained by mixing carbon with a material of high dielectric constant.

621.318.4 **654**

Component Design Trends—High-Frequency Coils use New Core Materials.—F. Rockett. (*Electronics*, Dec. **1954**, Vol. **27**, No. 12, pp. 140–143.) Points discussed include use of ferrite cores for coils operating at frequencies up to about 100 Mc/s, use of glass and other low-loss materials for formers and use of toroidal constructions.

621.319.4 **655**

The Capacity and Field of a Split Cylindrical Condenser, using the Method of Inversion.—H. J. Peake & N. Davy. (*Brit. J. appl. Phys.*, Sept. **1954**, Vol. **5**, No. 9, pp. 316–321.) "The complex potential of a split cylindrical condenser is obtained by inversion of a known, simpler case. Expressions are obtained for the value of the electrostatic field at points on the axes of symmetry, the surface density of charge on a conductor and the capacity of the condenser. The expressions obtained by Adams, using another method, are deduced as one of three special cases for which tables and graphs are provided. The results should prove of value in the design of electrode systems for various purposes."

621.319.42 **656**

Miniature Lacquer-Film Capacitors.—D. A. McLean & H. G. Wehe. (*Proc. Inst. Radio Engrs*, Dec. **1954**, Vol. **42**, No. 12, pp. 1799–1805.) A manufacturing process is described in which a thin film is cast on a supporting base and is metallized and slit while still supported, after which it is stripped and wound into capacitor units. Metallized films 0·1 mil thick have been produced; the resulting capacitors are about a seventh the size of the smallest metallized-paper types. The support may be left in if the film is extremely fragile or if the capacitor is to operate at voltages below about 15 V. A formula is derived for the effective series resistance.

621.372.412 **657**

Thickness-Shear and Flexural Vibrations of a Circular Disk.—R. D. Mindlin & H. Deresiewicz. (*J. appl. Phys.*, Oct. **1954**, Vol. **25**, No. 10, pp. 1329–1332.) Antisymmetrical modes of vibration in an AT-cut quartz disk are investigated by considering the simpler corresponding case of an isotropic disk. Differences between the frequency spectrum in this case and in that of the rectangular plate [1861 of 1951 (Mindlin)] are due to the presence of thickness-twist modes in addition to the thickness-shear and flexural modes.

621.372.413 **658**

Theory of Coupled Endovibrators [cavity resonators].—A. I. Akhiezer & G. Ya. Lyubarski. (*Zh. tekh. Fiz.*, Sept. **1954**, Vol. **24**, No. 9, pp. 1697–1706.) A system of two cavity resonators coupled by means of a narrow slot in their common wall is considered theoretically. Two classes of oscillations are considered: (*a*) those whose frequencies are determined primarily by the length of the slot and are nearly independent of the shape of the resonators; (*b*) those whose frequencies are near the frequencies of the oscillations in the resonators when not coupled.

621.372.5 **659**

The Wien Bridge as a Phase Shifter.—J. M. Diamond. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1807–1808.) Several circuits are presented illustrating the use of the Wien bridge to provide phase shift with small amplitude change.

621.372.5 **660**

Networks Attenuation and Input Impedance.—R. Talks. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, pp. 29–30.) Useful formulae are presented.

621.372.54 **661**

Four-Terminal Networks with Transfer Function having Zeros with Small Real Part.—W. Krägeloh. (*Frequenz*, Aug. 1954, Vol. 8, No. 8, pp. 249–256.) Analysis of low-pass filter networks based on insertion-loss principles [2940 of 1940 & 3226 of 1942 (Bader)] to investigate the effect of 'critical' zeros in the transfer-function plot on the reactance to be developed, the accuracy required in the calculation, and the component values.

621.372.622 **662**

Some Aspects of Mixer-Crystal Performance.—P. D. Strum. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1806–1807.) Correction to paper abstracted in 2941 of 1953. Please note change of U.D.C. number.

621.373.421.11.016.35 **663**

Criteria for the Amplitude Stability of a Power Oscillator.—W. R. MacLean. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1784–1791.) Stability criteria for a tuned-anode oscillator are established in the form of two inequalities derived from differential equations expressing the voltage variations of the grid and anode, and involving the ratio of feedback power to anode power, the ratio of the time constant of the grid-leak and capacitor combination to the time constant of the tank circuit, and functions of the angles of current flow for grid and anode. Experimental verification of the results using a Type-3C24 triode is reported.

621.373.43 : 517.93 **664**

Investigation of the Dependence of Natural Frequency of Oscillation on Spectral Composition.—I. I. Minakova. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1677–1686.) A particular case of the theory of nonlinear electric oscillations is considered. Writing the solution of the equation $\ddot{x} + \psi(x)\dot{x} + \omega_0{}^2x = 0$ as the sum of $A_k\sin(k\omega t + \phi_k)$, where A_k is the amplitude of the kth harmonic given by the Fourier series, the ratio $\omega^2/\omega_0{}^2 = \sum\limits_1^n A_k{}^2/\sum\limits_1^n k^2A_k{}^2$. Using this relation, the dependence of ω on the amplitudes of the spectrum can be calculated. The measured and calculated frequency characteristics of relaxation oscillators agreed well. The results are presented graphically. See also van der Pol, *Proc. Inst. Radio Engrs*, Sept. 1934, Vol. 22, No. 9, pp. 1051–1086, for a general introduction.

621.374.4 : 621.314.63 **665**

Crystal Frequency Multipliers for Centimetre and Millimetre Waves.—L. Grifone. (*Ricerca sci.*, Sept. 1954, Vol. 24, No. 9, pp. 1870–1879.) Circuits are described for generating harmonics at frequencies >30 kMc/s, using Type-IN23B crystals. The generator is coupled by a cross-bar transition to the crystal, which can be shifted axially for purposes of impedance matching. Higher frequencies can be achieved by use of Type-IN26 crystals in a similar arrangement.

621.375.2.018.75 **666**

On the Faithful Reproduction of the Flat Top of a Pulse in a High Fidelity Pulse Amplifier: Part 2.—B. K. Bhattacharyya. (*Indian J. Phys.*, Nov. 1953, Vol. 27, No. 11, pp. 565–577.) An experimental verification is reported of analysis presented previously (3566 of 1953). It was demonstrated that the anode current may sag appreciably if the time constants of the cathode and screen-grid *RC* circuits are not properly chosen.

621.375.223 + 621.373.421 **667**

Resonance Circuits comprising *RC* or *RL* Elements, and some Applications.—H. Müller. (*Funk u. Ton*, Sept. 1954, Vol. 8, No. 9, pp. 471–479.) The frequency characteristics of the Wien bridge and of an analogous inductance bridge are investigated theoretically. Pseudo-resonance phenomena occurring in the neighbourhood of bridge balance are discussed. True resonance is obtained when the bridge is associated with a feedback circuit to act as an oscillator. The tuned *RC* amplifier and the *RC* and *RL* oscillators are described.

621.375.23 **668**

Multistage Amplifier Output Impedance.—J. B. Earnshaw. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, p. 553.) Based on the result that the ratio of the net amplification to the parallel output impedance of a simple amplifier is the same with and without voltage feedback, a simple expression is obtained relating the parallel output impedance to the amplifier constants for the multistage amplifier with overall feedback. The design of an amplifier with a gain of 1 000 and a parallel output impedance of 1 Ω is discussed briefly.

621.375.3 **669**

Magnetic Amplifiers.—G. M. Ettinger. (*Elect. Rev., Lond.*, 3rd Sept. 1954, Vol. 155, No. 10, pp. 348–352.) A general survey of types and applications.

621.375.3 **670**

Three-Phase High-Speed Magnetic Amplifiers.—A. E. Maine. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 514–521.) The principle of the 'half-wave' magnetic amplifier is extended to three-phase circuits. Various arrangements are described. Applications in the field of high-power control systems are discussed.

621.375.4.026 **671**

The Transistor as a D.C. Amplifier for use in Microwave Measurements.—C. F. Davidson. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 548–549.) A junction-type transistor with emitter earthed may have a current amplification as high as 50, with low input impedance and high output impedance. Such an arrangement is useful for amplifying the current from a Si rectifier before application to a meter, and enables the usual galvanometer to be replaced by a robust microammeter.

621.375.5 **672**

Analyses of Basic Dielectric Amplifier Circuits.—Shou-Hsien Chow. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1297–1301.) Analysis is based on a simplified charge/voltage characteristic neglecting hysteresis; both parallel- and series-connected arrangements are studied. The steady-state response can be found with a high degree of accuracy by a method involving successive approximations; transient response is also discussed.

GENERAL PHYSICS

535.215 **673**

Photoelectric Emission in the Extreme Ultraviolet.—H. E. Hinteregger. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 538–539.) Results of experimental studies on photoelectric emission from various metals for quantum energies up to 21·2 eV cannot even qualitatively be accounted for by the common 'free-electron'–'surface effect' representation. A new theoretical model capable of explaining the observations at high photon energies is presented.

537.226 : 537.52 **674**

The Influence of the Cathode Material on Measured Breakdown Strengths of Solid and Liquid Dielectrics.—J. J. O'Dwyer. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 400–409.)

537.311.31 **675**

Kinetic Equation for Electrons in Metals in Strong Fields.—V. P. Shabanski. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 142–146.) See also 676 below.

537.311.31 **676**

On Deviations from Ohm's Law in Metals.—V. P. Shabanski. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 147–155.) It is shown, on the basis of the kinetic equations of electrons in metals in strong fields (675 above), that the deviations observed are due primarily to the delayed transmission of energy at the collision of electrons with the lattice. At sufficiently low temperatures, the resistance should pass through a minimum at a given current.

537.52 **677**

On the Dependence of the Decay Times of Space Charges by the Static Characteristic in Intermittent Discharges.—D. Brini, O. Rimondi & P. Veronesi. (*Nuovo Cim.*, 1st Sept. 1954, Vol. 12, No. 3, pp. 413–424. In English.) The validity of the hypothesis previously formulated [2068 of 1954 (Brini & Veronesi)] has been investigated experimentally. Measured decay times depend on the external circuit associated with the discharge tube, but the existence of an inherent decay time dependent only on the static characteristic of the tube is indicated. An empirical method is developed for calculating decay times.

537.52 **678**

Space Charge Formation and the Townsend Mechanism of Spark Breakdown in Gases.—R. W. Crowe, J. K. Bragg & V. G. Thomas. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 10–14.)

537.523.4 **679**

Measurement of the Current during the Formative Time Lag of Sparks in Uniform Fields in Air.—H. W. Bandel. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1117–1125.) Measurements were made of the current in a parallel plane gap during the period between application of a voltage and occurrence of breakdown. The current increased from 10^{-6} A a few microseconds after application of the voltage to 10^{-2} A just before breakdown, for time lags between 10 and 100 μs. The results are in agreement with previously developed theory, except for an observed delay in the initial current rise; a possible explanation of this is discussed.

537.525.72 : 537.562 **680**

Determination of the Electronic Temperature in U.H.F. Gas Discharges.—M. Bayet & F. Guérineau. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1029–1031.) Measurements made in an electrodeless discharge over a pressure range 0·13–11 mm Hg and an electron-concentration range of ratio 1 to 80 indicate that the electronic temperature remains practically constant, its value being 30 000°K to within 10% in dry air.

537.533 : 537.534.8 **681**

Auger Ejection of Electrons from Tungsten by Noble Gas Ions.—H. D. Hagstrum. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 325–335.) Report of an experimental investigation using atomically clean tungsten and ions with various charges. The results indicate a value of about 6·3 eV for the energy of the Fermi level above the ground state in the conduction band in tungsten.

537.533 : 537.534.8 **682**

Theory of Auger Ejection of Electrons from Metals by Ions.—H. D. Hagstrum. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 336–365.)

537.533.73/.74 **683**

Diffraction and Inelastic Scattering of Electrons [in metals].—A. Ya. Vyatskin. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 162–170.)

537.533.8 : 546.45 **684**

Secondary Electron Emission from Thin Layers of Be : Part 1.—I. M. Bronshtein & T. A. Smorodina. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 215–223.) An experimental investigation is reported of the change of the secondary emission coefficient (σ) and the electron energy distribution with the adsorption of Be atoms on Ni. σ decreases monotonically with adsorption of pure Be, but increases at first with impure Be, decreasing finally to σ_{Be}. The emission depth of secondary electrons depends linearly on the energy of the primary electrons in the range 100–600 eV.

537.533.8 : 546.561 **685**

Investigation of Energy-Distribution Function of Secondary Electrons from Cu Single Crystal covered with a Single-Crystal Cu_2O Layer using the Method of Electrical Differentiation.—N. B. Gornyi. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 171–179.) The subsidiary maxima observed previously (2918 of 1954) are confirmed and discussed. See also 3527 of 1954 (Gornyi & Rakhovich).

537.562 : 538.561 **686**

Dielectric Constant of Plasma in Stationary Magnetic Field.—M. E. Gertsenshtein. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 180–188.) The tensor of the complex dielectric constant is calculated taking into account the thermal motion of the electrons. It is shown that in a system of coordinates connected with the moving electron, the field of a monochromatic plane electric wave is frequency modulated, hence resonance effects occur at higher harmonics. Gaps in the plasma oscillation spectrum at multiples of the gyromagnetic frequency [2151 of 1951 (Gross)] can only occur if two conditions are satisfied; the first is the condition for resonance effects to occur with all electrons, the second gives the condition for high intensity of higher harmonics. With radio waves the effect of higher harmonics is negligible and hence there are no gaps in the radio wave spectrum. The conditions are satisfied in the case of sound waves in ionized gas and the effects due to resonance at multiples of the gyromagnetic frequency can be considerable.

537.581 : 546.56 **687**

Thermionic Emission from Copper at the Melting Point.—V. G. Bol'shov & L. I. Dobretsov. (*C. R. Acad. Sci. U.R.S.S.*, 11th Sept. 1954, Vol. 98, No. 2, pp. 193–196. In Russian.) An experimental determination is reported of the constants A and ψ in the Richardson-Dushman equation $j = AT^2\exp(-\epsilon\psi/kT)$, where ϵ is the electron charge and ψ is the effective or isothermal work function. For solid Cu at the melting point the values of A and ψ were 16·7 A.cm^{-2}.deg^{-2} and 4·4 V respectively, for liquid Cu $3{\cdot}2 \times 10^5$ A.cm^{-2}.deg^{-2} and 5·5 V respectively. The discontinuity at the melting point is discussed.

538.1/.2 **688**

Recent Developments in Magnetism.—E. P. Wohlfarth. (*Research, Lond.*, Sept. 1954, Vol. 7, No. 9, pp. 360–367.) A survey with reference to 16 publications dealing with various aspects of the subject.

538.122 **689**

Magnetic Flux produced by a Dipole Located inside a Ferromagnetic Circular Wire.—S. M. Rytov. (*Zh. eksp. teor. Fiz.*, Sept. 1954, Vol. 27, No. 3(9), pp. 307–312.) An approximate formula is derived for the magnetic flux through a coaxial plane circular area normal to the wire, due to a magnetic dipole element inside the wire. The radii of the circular area and the wire are assumed to be small compared with the axial distance between the circular area and the dipole element. For experimental confirmation of the formula see Grachev et al. (690 below).

538.122 **690**

Experimental Investigation of Change of Magnetic Flux in a Wire when One Domain is Remagnetized.—A. A. Grachev, K. A. Goronina, N. N. Kolachevski & I. A. Andrianova. (*Zh. eksp. teor. Fiz.*, Sept. 1954, Vol. 27, No. 3(9), pp. 313–317.) The problem, which is of importance in magnetic recording, was investigated theoretically by Rytov (689 above); the calculated and experimental results are in good agreement.

538.221 : 538.566 **691**

Theory of Strong Electromagnetic Waves in Massive Iron.—W. MacLean. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1267–1270.) Maxwell's equations are solved for propagation in material having a rectangular hysteresis curve. Formulae are derived for depth of penetration, wave impedance and power input. The results are compared with those of Rosenberg (*Electrician*, Aug. 1923, Vol. 91, p. 188). See also 2006 of 1954 (Papoulis).

538.566 **692**

Reflection from a Wire Grid Parallel to a Conducting Plane.—J. R. Wait. (*Canad. J. Phys.*, Sept. 1954, Vol. 32, No. 9, pp. 571–579.) The parallel-wire grid backed by a conducting plane can be represented by an impedance shunted across a transmission line as in the case of a single wire [2589 of 1948 (Macfarlane)]. The value of this impedance depends on the angle of incidence, the spacing of the grid wires, and the distance between grid and backing plane. Conditions are derived for the reflection coefficient to become zero.

538.566 : 535.42 **693**

Diffraction of Electromagnetic Waves by an Aperture in a Plane Screen.—R. D. Kodis. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1342–1343.) Discussion of 709 of 1954 (Bekefi) and 2078 of 1954 (Crysdale).

538.566 : 535.42 **694**

The Diffraction of Waves by an Irregular Refracting Medium.—E. N. Bramley. (*Proc. roy. Soc. A*, 22nd Sept. 1954, Vol. 225, No. 1163, pp. 515–518.) "A method is described of calculating the diffraction effects produced by a thick stratum of an irregular refracting medium. It consists of evaluating the statistics of the phase irregularities in the wave-front after traversing the medium, and treating these irregularities as having been produced by a thin phase-changing screen. For a particular statistical model of the irregularities in the medium the result is shown to be identical with that obtained by Fejer [1730 of 1954] using a different method."

538.566 : 535.42 : 517.942.9 **695**

A Further Note on Dual Integral Equations and an Application to the Diffraction of Electromagnetic Waves.—C. J. Tranter. (*Quart. J. Mech. appl. Math.*, Sept. 1954, Vol. 7, Part 3, pp. 317–325.) A solution obtained previously (1614 of 1951) is extended to cover cases in which the order of the Bessel-function kernel is not zero. As an example, the solution is applied to a problem in the diffraction of e.m. waves by a plane slit; Groschwitz & Hönl's discussion of the problem (2183 of 1952) is criticized. Results obtained are in agreement with those of Müller & Westpfahl (1971 of 1953).

538.632 : 537.525 **696**

Hall Effect in Positive Column.—K. Takayama, T. Suzuki & T. Yabumoto. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 531–532.) Report of measurements of Hall voltage in the positive column of d.c. gas discharge tubes, as a function of magnetic field, tube current, distance between probes and gas pressure.

538.632 : 538.221 **697**

Theory of Hall Effect in Ferromagnetics.—N. S. Akulov & A. V. Cheremushkina. (*C. R. Acad. Sci. U.R.S.S.*, 1st Sept. 1954, Vol. 98, No. 1, pp. 35–38. In Russian.) Assuming *s-d*-phonon interaction, the Hall voltage is given by the equation $e = [a_0\rho_0 + a_2\,(\rho_T - \rho_0)]\,I_s i$, where a_0 and a_2 are constants, ρ_0 and ρ_T are the resistances of the specimen at absolute zero and at temperature T, respectively, I_s is the intensity of magnetization at saturation and i is the current density. Comparison with experimental results obtained from measurements on a bar-shaped 45%-Ni/55%-Fe specimen (containing stated impurities) shows close agreement.

538.632 : 538.221 **698**

Hall Effect in Ferromagnetics.—R. Karplus & J. M. Luttinger. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1154–1160.) Anomalous effects are explained in terms of the spin-orbit interaction of polarized conduction electrons.

548.0 : 53 **699**

Wave Functions for Impurity Levels.—G. F. Koster & J. C. Slater. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1167–1176.) A general method of solving difference equations arising in impurity calculations is developed.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 + 621.396.11 + 621.396.9 **700**

Propagation of Electromagnetic Waves, Radio Location and Radio Astronomy.—E. Roessler. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 632–635.) A brief survey of recent progress, particularly since 1951. 73 references.

523.16 **701**

Detection of Discrete Radio Sources at 21 cm Wavelength.—J. P. Hagen, E. F. McClain & N. Hepburn. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, p. 1811.) Details are tabulated of 20 sources observed at the U.S. Naval Research Laboratory. The equipment used is briefly described.

523.16 **702**

Nature of Discrete Sources of Cosmic R.F. Radiation.—I. S. Shklovski. (*C. R. Acad. Sci. U.R.S.S.*, 21st Sept. 1954, Vol. 98, No. 3, pp. 353–356. In Russian.) Energy considerations of the colliding gas 'coronas' in Cygnus A show that a considerable proportion of the kinetic energy of the colliding masses is transferred to a relatively small number of relativistic particles and hence into r.f. radiation. The cut-off frequency is estimated to be about 2×10^{10} c/s assuming the particles to be electrons.

523.16 **703**

Observations of Cosmic Noise at 9·15 Mc/s.—C. S. Higgins & C. A. Shain. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 460–470.) "From observations made at a frequency of 9·15 Mc/s, with an aerial of beam width 29° between half-power points and directed to Dec. —32°, a curve of equivalent aerial temperature, as a function of sidereal time, is derived. The temperatures observed were of the order of 10^6°K. The curve is compared with curves derived for similar conditions by calculation from the results of observations at 18·3 Mc/s and at 100 Mc/s. It is found that the equivalent temperatures increase rapidly with decreasing frequency, but the ratio of maximum to minimum temperature decreases with frequency. It is shown that 'atmospheric' noise levels observed by the standard techniques sometimes contain a large contribution from cosmic noise at this frequency."

523.72 : 621.396.822 **704**

Harmonics in the Spectra of Solar Radio Disturbances.—J. P. Wild, J. D. Murray & W. C. Rowe. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 439–459.) Detailed account of observations reported previously (391 of 1954). Investigations over the frequency range 40–240 Mc/s indicate that spectral features of solar noise bursts are commonly duplicated at or below the frequency of the second harmonic. The results are consistent with the hypothesis that the fundamental frequency corresponds to the natural plasma frequency of the corona in the vicinity of the source. By applying this result to a standard model of the corona, information is deduced regarding the position, velocity and size of the sources. Velocities of 500 and 4 000 km/s were found for two long-duration outbursts, and velocities as great as 10^5 km/s for short-lived type-III bursts. The generation of bursts may be associated with longitudinal plasma oscillations excited by fast streams of charged particles.

523.746 : 621.396.822 **705**

The Emission Polar Diagram of the Radio-Frequency Radiation from Sunspots.—K. E. Machin & P. A. O'Brien. (*Phil. Mag.*, Sept. 1954, Vol. 45, No. 368, pp. 973–979.) The variation in received sunspot radiation with solar rotation was determined from a statistical analysis of observations made over a number of years. Half-power widths of the radiation pattern of an average sunspot, derived from this analysis, are 15°, 20° and 36° for frequencies of 81·5, 175 and 500 Mc/s respectively. Results indicate that the lifetime of the radiation sources is shorter for the lower frequencies; the lifetime at 175 Mc/s is comparable with that of a visible spot.

551.510.535 **706**

Abnormal Amplitude of Seasonal Effects in the Ionosphere at the Equator, and Structure of the Upper Atmosphere.—F. Delobeau & R. Gallet. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1067–1069.) D-layer absorption, maximum ionization and structure of the F_2 layer have been studied. Seasonal variations observed in equatorial regions are much greater than expected from the geometrical variation of the sun's position. Known theories assume simple variation of ionosphere parameters with cos χ. The deviations observed are interpreted as indicating seasonal variations of the structure of the upper atmosphere, particularly as regards temperature and its gradient, molecular dissociation and movements of air masses. At an equatorial station at the solstices, not only is the solar radiation incident at an angle of 23°, but the structure of the upper atmosphere is that appropriate to a latitude of about 23°.

551.510.535 **707**

Motion of a Single Cloud in the Ionosphere.—S. N. Mitra. (*Indian J. Phys.*, Nov. 1953, Vol. 27, No. 11, pp. 562–564.) The system comprising cloud and ionosphere is treated as analogous to the system formed by a horizontal wire aerial and the ground. The radiation pattern consists of minor lobes arranged symmetrically with respect to a central major lobe; as this pattern moves with the cloud, periodic fading of transmitted pulses is observed at the receiver. Periodic fading preceded and followed by a steady signal can thus, with appropriate reservations, be interpreted as due to a single cloud. An example is discussed in which 14 maxima were observed; the wavelength being 75 m, the horizontal length of the cloud is estimated to be about 1 km.

551.510.535 **708**

A Monochromatically Ionized Layer in a Non-Uniformly Recombinant Atmosphere; with Applications to the D and E Ionospheric Regions.—S. Chapman. (*Proc. phys. Soc.*, 1st Sept. 1954, Vol. 67, No. 417B, pp. 717–727.) The recombinance α of the atmosphere is assumed to be given by a term α_0 independent of height together with a term $\alpha_1 e^{-bh}$ which varies exponentially with height. A recombinance datum level is defined as that at which the two terms are equal, and heights are measured from this level, in scale-height units. " The level of the absorption peak being z_χ (when the sun's zenith distance is χ, or z_0 when $\chi = 0$), the level z_m of the electron peak and the height distribution of the electron density n_e are considered, for different values of z_0 and of $c(= b/H)$, particularly $c = 1, 2, 3$. When $c > 0$ the electron peak is always above the absorption peak, and for $c \geqslant 2$ it is always above the recombinance datum level: the electron peak for $c = 1$, when the absorption peak is below the recombinance datum level, is about half way between the two. The decrease of n_e (from its maximum value n_{em}) on the underside (or incline) of the electron layer can be much less steep than for a Chapman layer, if the absorption peak is below the recombinance datum level. The results for the model atmospheres considered are tentatively discussed with reference to the E and D ionospheric regions, but their potential value may be realized only when better data for the D region become available."

551.510.535 : 538.566 **709**

Focusing Phenomena due to Undulations of the Ionosphere, and Determination of Collision Number.—Rawer & Argence. (See 842.)

551.510.535 : 551.594.5 **710**

Electron Density in the E-Layer during Auroral Displays deduced from Measurements of Absolute Brightness of the Auroral Luminosity.—A. Omholt. (*J. atmos. terr. Phys.*, Sept. 1954, Vol. 5, No. 4, pp. 243–244.) Values of electron density calculated from the photon emission for different auroral forms range from $1\cdot6 \times 10^6$ to 12×10^6 electrons/cm^3. See also 716 below (Seaton).

551.510.535 : 551.594.5 **711**

The Association of Pulsating and Flaming Auroras with Complete Ionospheric Absorption at Macquarie Island.—G. Major. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 471–476.) Simultaneous records show that pulsating or flaming aurorae are frequently accompanied by complete absorption of waves incident vertically on the ionosphere, but the nocturnal variations of frequency of occurrence of the two phenomena are markedly different in form.

551.510.535 : 621.3.087.4 **712**

Equipment for Accurate Measurement of Height of Ionosphere Layers.—S. J. Bauer. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, Sept./Oct. 1954, Vol. 8, Nos. 9/10, pp. 122–125.) Use of a 200-μs timebase, corresponding to a height range of 30 km, enables measurements to be made accurate to within 1 km. The timebase triggering is controlled by means of a phase shifter calibrated in height, so that any desired height range can be selected for close examination. Because of the pulse widening involved, a differentiator stage with wide-band amplifier is interposed between receiver output and indicator. Measurement procedure is described.

551.510.535 : 621.3.087.4 **713**

Ionospheric Height Measurement by the Method of Delayed Coincidence.—H. Rakshit & S. D. Chatterjee. (*Naturwissenschaften*, Sept. 1954, Vol. 41, No. 17, pp. 401–402. In English.) An outline description, with block diagram, is given of equipment in use at an Indian station for regular observation of lunar tides in the upper atmosphere. The apparatus can be readily adapted for automatic recording of *h't* curves. The method is basically as described previously (*Sci. & Cult.*, 1952, Vol. 17, p. 520), but the technique has been improved, giving an accuracy within ±0·1 km. Good results are obtained even in the presence of heavy atmospherics.

551.510.535 : 621.396.812.3.029.53 **714**

Periodic Fading of Medium-Wave Radio Signals.—B. R. Rao & N. V. G. Sarma. (*Curr. Sci.*, Sept. 1954, Vol. 23, No. 9, pp. 287–288.) Slow fading was found to correspond to interference between 1 × E and 2 × E paths and between 2 × E and 3 × E paths, rapid fading to interference between 1 × E and 3 × E paths. The values of the vertical drift velocity of the E layer calculated on the basis of observations of the three types of interference at an Indian station, for the period between 0700 and 0800 hours, were 2·15 m/s, 2·34 m/s, and 2·29 m/s respectively. Ground-wave fading indicates a drift velocity of 2·37 m/s. Analysis of records shows that the drift velocity decreases during the morning; depth of fading also decreases, due to increasing D-layer absorption.

551.594.5 **715**

Variations of Intensity of the Aurora at Macquarie Island.—F. Jacka. (*Aust. J. Phys.*, Sept. 1954, Vol. 7, No. 3, pp. 477–484.)

551.594.5 **716**

Excitation Processes in the Aurora and Airglow: Part 1 — Absolute Intensities, Relative Ultraviolet Intensities and Electron Densities in High-Latitude Aurorae. Part 2 — Excitation of Forbidden Atomic Lines in High-Latitude Aurorae.—M. J. Seaton. (*J. atmos. terr. Phys.*, Jan. 1954, Vol. 4, No. 6, pp. 285–313.) The excitation processes are evaluated on the basis of optical and r.f. observations. Calculations show that electron densities of 10^7–10^8cm^{-3} occur in bright high-latitude aurorae. A summary is given of the various excitation and de-activation processes which may occur and an attempt is made to decide which of these will be of major importance.

551.594.6 **717**

Atmospherics with Long Trains of Pulses.—F. Hepburn & E. T. Pierce. (*Phil. Mag.*, Sept. 1954, Vol. 45, No. 368, pp. 917–932.) "The waveforms of atmospherics having long-continued trains of pulses and the systematic modifications associated with time of recording, storm distance and the presence of a low-frequency component, are described. Their interpretation is discussed and the results of analysis—assuming the simple ionospheric reflection mechanism—are presented. Estimates of reflection height and storm distance show the applicability of the theory to the temporal parameters of the waveforms, and the origins of two groups of atmospherics having calculated ranges of 4 500 and 7 000 km are considered. The variation of pulse amplitude with reflection order is shown to lead to the postulation of horizontal radiating elements in the channel during the later stages of the return stroke, although difficulties arise in reconciling this concept with considerations of the magnitude and orientation of the horizontal elements." See also 2771 of 1953.

LOCATION AND AIDS TO NAVIGATION

621.396.9 + 621.396.11 + 523.16 **718**

Propagation of Electromagnetic Waves, Radio Location and Radio Astronomy.—E. Roessler. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 632–635.) A brief survey of recent progress, particularly since 1951. 73 references.

621.396.96.012.3 **719**

Radar Doppler Nomograph.—A. H. Schooley. (*Electronics*, Dec. 1954, Vol. 27, No. 12, p. 180.) A nomogram is presented relating the Doppler frequency shift to transmitter frequency and target velocity.

621.396.963.325 **720**

P.P.I. Light-Spot Brightness Probability Distributions.—G. C. Sponsler & F. L. Shader. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1271–1277.) A study is made using the statistics of noise theory. For a Type-10KP7 c.r. tube, the intensifier electrode has an approximately 2·5-power-law characteristic; this combines with the square-law second detector to give an overall 5th-power detection characteristic. The spot brightness is investigated for integration of seven individual returns. "Various mathematical methods of handling the problem are considered. The Edgeworth series approximation is found to give poor results compared with the Laguerre polynomial approximation. By the latter method the light brightness probabilities are found to be obtainable by interpolation from a table of the incomplete gamma function. Ancillary tables of statistical moments and selected values of the confluent hypergeometric function, ${}_1F_1$ $(-5n/2;\ 1;\ -x)$, are included in the text."

621.396.969 : 551.577/.578 **721**

Radar Echoes from Monsoon Rain.—L. S. Mathur, A. C. De, B. N. Dutta & H. Mitra. (*Indian J. Met. Geophys.*, April 1954, Vol. 5, No. 2, pp. 173–186.) Account of observations made at New Delhi, using modified Type-AN/APQ-13 3-cm radar equipment. P.p.i. displays corresponding to different weather conditions are reproduced.

621.396.969.33/.34 : 621.396.822 **722**

The Reduced Range in a Radar Subjected to an External Noise Generator.—U. Tiberio. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1791–1798.) An analytical method is described for calculating the reduction of range due to a noise generator (*a*) carried by the target, or (*b*) at some fixed location. A 'reduced range index' is determined from consideration of free-space operation against aircraft, and the effect of reflection from the sea is investigated in relation to operation at low height against ships. The effect of noise on the visibility factor is briefly discussed.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **723**

Ion Pump.—P. F. Váradi. (*Acta tech. Acad. Sci. hungaricae*, 1954, Vol. 9, Nos. 3/4, pp. 343–353. In English.) The ultimate pressure and pumping speed calculated for the case of a simple model are in agreement with experimental results of Foster et al. (*Rev. sci. Instrum.*, May 1953, Vol. 24, No. 5, pp. 387–390), who described an ion pump with pumping speeds between 3 000 and 7 000 l/sec at a base pressure of about 10^{-6} mm Hg. The present experimental result indicates that the reduction of gas pressure is attributable not solely to adsorption but also to a true pumping effect.

535.215 : [537.311.33 + 537.226 **724**

Photoeffect from Surface Levels.—G. E. Pikus. (*Zh. eksp. teor. Fiz.*, Sept. 1954, Vol. 27, No. 3(9), pp. 369–381.) The external photoeffect in semiconductors and dielectrics, corresponding to removal of electrons from the surface zone, is considered theoretically. Expressions are derived for the energy distribution of the emitted photoelectrons and the quantum output and its dependence on the frequency of the incident light.

535.215 : 546.482.21 **725**

Photovoltaic Effect in Cadmium Sulfide.—D. C. Reynolds, G. Leies, L. L. Antes & R. E. Marburger. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 533–534.) Brief report of observations.

535.215 : 546.482.21 **726**

Absorption and Conductivity Measurements on CdS in the Soft-X-Ray Region.—E. Schnürer. (*Ann. Phys., Lpz.*, 15th Sept. 1954, Vol. 15, No. 1, pp. 15–20.)

535.215 : 546.817.241 : 539.23 **727**

Effect of Oxygen on the Electrical Properties of Lead Telluride Films.—D. E. Bode & H. Levinstein. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 259–265.) Account of an experimental investigation. Exposure to oxygen produces first an increase and then a decrease in the film resistance. The nature of the material changes from *n*-type to *p*-type in the neighbourhood of the resistance maximum. The magnitudes of the photoconductive and photovoltaic effects depend on the amount of oxygen adsorbed. The observed results are explained on the basis of a model in which the oxygen removes electrons first from the conduction band, then from trapping states, and finally from the valence band.

535.37 **728**

On the Infrared-Sensitive Behaviours of Some Doubly Activated ZnS Phosphors.—S. Asano. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, pp. 580–594.)

535.37 **729**

Investigations of the Stimulation of Phosphorescence in Calcium Oxide.—A. Crozet & J. Janin. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1031–1034.) The effect of different activators is discussed. If rare earths are used there is a large recapture of liberated electrons.

537.226.2 **730**

The Dielectric Behaviour of Acetaldehyde Vapour at 9 000 Mc/s.—Krishnaji & P. Swarup. (*Z. Phys.*, 18th Sept. 1954, Vol. 138, No. 5, pp. 550–556. In English.)

537.226.31 **731**

Investigation of Dielectric Losses due to Low-Frequency Relaxation in Polyethylene.—G. P. Mikhailov, A. M. Lobanov & B. I. Sazhin. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1553–1560.) Experimental results show that the losses are connected with the presence of C=O polar groups and their orientation. The relaxation time associated with l.f. ($\sim 10^2$ c/s) losses decreases with extension of the specimen, that of h.f. ($\sim 10^9$ c/s) losses increases. The dependence of the loss angle on temperature, frequency, and percentage of crystalline phase is shown graphically.

537.226.33 **732**

Transient State in Dielectrics.—J. Granier & P. Caillon. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1025–1027.) If only one hysteresis effect came into play, it would be possible to predict a.c. dielectric properties from d.c. properties. Examination of experimental results on high polymers confirms the existence of two independent hysteresis phenomena, the one related to the dipole orientation and the other to ionic polarization. See also 2963 of 1954.

537.227 : 546.431.824-31 **733**

Electromechanical Activity of $BaTiO_3$ Ceramic subjected to Opposing Polarization.—T. F. Hueter & D. P. Neuhaus. (*Naturwissenschaften*, Sept. 1954, Vol. 41, No. 18, p. 424.) Over a range of field strength within the coercive field strength, second-harmonic oscillations become pronounced while the fundamental and the third harmonic disappear. Curves showing the variation of fundamental and second-harmonic amplitude with field strength are presented for a disk of thickness 0·1 cm, and an interpretation is provided in terms of domain processes.

537.227 : 546.431.824-31 **734**

An Experimental Study of Polarization Effects in Barium Titanate Ceramics.—T. F. Hueter, D. P. Neuhaus & J. Kolb. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 696–703.) The following points were investigated: (*a*) transducer performance as a function of polarizing bias; (*b*) relative role of mechanical and dielectric losses; (*c*) coercivity of pre-polarized $BaTiO_3$; (*d*) effect of bias on subsidiary transducer responses; (*e*) constriction of dielectric hysteresis loops. The value of the experiments for elucidating the relation between the properties of the ceramic and single-crystal forms of the material is discussed.

537.227 : 546.431.824-31 **735**

Dielectric-Constant Behavior of Single-Domain, Single Crystals of Barium Titanate in the Vicinity of the Curie Point.—M. E. Drougard & D. R. Young. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1152–1153.) Brief report of measurements which confirm earlier observations by Cross (751 of 1954) of a discontinuity in the value of the dielectric constant at the Curie point.

537.227 : 546.431.824.831.4-31 **736**

Ferroelectric Properties of Solid Solutions of Barium Zirconate in Barium Titanate.—G. A. Smolenski, N. P. Tarutin & N. P. Grudtsin. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1584–1593.) An experimental investigation of solutions containing up to 40% (molar) of $BaZrO_3$. Results, which are presented graphically, show that (*a*) the highest value of dielectric constant ($> 12\,000$) at a frequency of 1 kc/s occurs for 18–20% $BaZrO_3$ content, (*b*) the Curie temperature is displaced downwards more slowly than in the $BaSnO_3$-in-$BaTiO_3$ solutions due to the different character of the bonds of Zr and Sn ions with oxygen ions, (*c*) the dielectric constant of solutions with low electrostriction falls considerably following polarization at high field strengths, (*d*) the dependence of resonance frequencies on field strength decreases with increase of the zirconate content, and (*e*) the piezoelectric-modulus maximum occurs at a temperature slightly lower than that corresponding to the dielectric-constant maximum. Some properties of pure $BaTiO_3$ were also investigated.

537.311.31 : [538.632 + 537.312.8 **737**

Hall Effect and Change of Resistance of Pb, Cu, and Mg in a Magnetic Field.—E. S. Borovik. (*Zh. eksp. teor. Fiz.*, Sept. 1954, Vol. 27, No. 3(9), pp. 355–368.) An experimental investigation is reported on pure polycrystalline specimens in fields of strengths up to about 25 000 oersted at temperatures between 2° and 300°K. From a comparison of the experimental results with results calculated on the basis of an isotropic model of a metal with overlapping energy bands values are obtained for the mobilities and concentrations of charge carriers. The magnitude of the mean free path is compared with the values obtained by other methods. Results are tabulated and presented graphically.

537.311.31 : 621.3.029.64 **738**

Surface Loss of Silver-Plated Metal Plates at 9 000 Mc/s and its Correlation with Surface Roughness.—S. Saito. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, p. 1810.) A cavity-resonator method is outlined for comparing the surface loss of metal plates. The surface roughness was simultaneously observed by a mechanical-stylus method and by means of electron micrographs. The results confirm that surface loss increases rapidly with increase in surface roughness. Plating defects in the silver-plated samples appear to be responsible for abnormally high losses.

537.311.33 **739**

Magnetoresistance Effect in Cubic Semiconductors with Spheroidal Energy Surfaces.—M. Shibuya. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1385–1393.) "The collision frequency of electrons having a spheroidal energy surface with acoustical modes of vibration is calculated without neglecting phonon energy. Using an asymptotic form in which the collision frequency is proportional to the square root of their energy the electronic current in a semiconductor in combined magnetic and weak electric fields can be calculated in a closed form by the formal theory of conductivity." The results are compared with those obtained experimentally by Pearson & Suhl (166 of 1952).

537.311.33 **740**

Mathematical Methods for Zone-Melting Processes.—H. Reiss. (*J. Metals, N.Y.*, Sept. 1954, Vol. 6, No. 9, Section 2, pp. 1053–1059.) The mechanism of zone melting [2125 of 1954 (Pfann)] is discussed in terms of a transport process including diffusive and convective flows. This approach provides a basis on which equations are developed for the solute concentration in the ingot as a function of the number of zone passes.

537.311.33 **741**

Quantum Theory of Cyclotron Resonance in Semiconductors.—W. Kohn & J. M. Luttinger. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 529–530.) For the electrons in semiconductors, the quantum theory is identical with the classical theory [2479 of 1950 (Shockley)]. For holes, the situation is complicated due to degeneracy at the top of the valence band; the quantum theory leads to different energy levels and selection rules for low quantum numbers, but for high quantum numbers the classical theory is again valid.

537.311.33 : 537.323 **742**

Temperature Dependence of Thermoelectric Power of Impurity Semiconductors.—T. A. Kontorova. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1687–1696.) Theoretical considerations show that the large values of the thermoelectric power observed by Frederikse (1093 of 1954) and others at very low temperatures can be accounted for by accepted theory, assuming the electron gas to be highly degenerate in that region. The maximum occurs at the transition from the degenerate state to the 'classical' state.

537.311.33 : 537.323 : 546.289 **743**

Theory of Thermoelectric Power in Semiconductors.—J. Tauc. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, p. 1394.) A method is suggested for calculating the thermoelectric power which gives a more correct expression than that presented by Johnson & Lark-Horowitz (1092 of 1954).

537.311.33 : 546.23 **744**

Some Investigations on the Electrical Properties of Hexagonal Selenium.—L. M. Nijland. (*Philips Res. Rep.*, Aug. 1954, Vol. 9, No. 4, pp. 259–294.) Known properties of Se are reviewed with references to published data. A method of purifying 99·9%-pure Se by evaporation at a temperature near its melting point is described. Results of measurements of h.f. conductivity confirm the assumption that polycrystalline Se consists of crystals of fairly good conductivity embedded in poorly conducting layers of amorphous Se. The inclusion of thallium increases the resistance of the layers without greatly affecting that of the crystals. Measurements of Hall effect and of equivalent shunt resistance as a function of frequency are also reported for pure and bromine-containing samples; results indicate the same layer structure, but inclusion of Br lowers the resistance of the layers. Conduction mechanism is discussed with reference to detailed experimental results.

537.311.33 : [546.28 + 546.289 **745**

Etch Pits and Dislocations in Germanium and Silicon.—J. J. Oberly. (*J. Metals, N.Y.*, Sept. 1954, Vol. 6, No. 9, Section 2, pp. 1025–1026.) Brief illustrated discussion of conical etch pits observed while examining lineage boundaries described by Vogel et al. (2693 of 1953).

537.311.33 : [546.28 + 546.289 **746**

Theory of Electron Multiplication in Silicon and Germanium.—P. A. Wolff. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1415–1420.) Multiplication of electrons and holes at junctions in Si and Ge is explained in terms similar to those of gas-discharge theory. The calculated ionization-rate/field characteristic for Si is in agreement with that obtained experimentally, assuming a mean free path of 200 Å for interactions between electrons and optical phonons.

537.311.33 : [546.28 + 546.289 **747**

Mobility of Impurity Ions in Germanium and Silicon.—C. S. Fuller & J. C. Severiens. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 21–24.) The diffusivity D of Li in Ge and Si was investigated by measuring the mobilities of the Li^+ ions on applying an electric field. Using the Einstein formula relating the two properties, the value of D was found to be $25 \times 10^{-4} \exp(-11\,800/RT)$ for Ge and $23 \times 10^{-4} \exp(-15\,200/RT)$ for Si, in satisfactory agreement with previously published results. The region into which the Li diffuses in the p-type Ge changes to n-type, but a small region round the injection area reverts to p-type. Similar experiments with Cu in n-type Ge are mentioned.

537.311.33 : [546.28 + 546.289] : 536.2 **748**

The Thermal Conductivity of Germanium and Silicon at Low Temperatures.—H. M. Rosenberg. (*Proc. phys. Soc.*, 1st Sept. 1954, Vol. 67, No. 417A, pp. 837–840.) "The thermal conductivity of a single crystal of Ge and a polycrystalline specimen of Si have been measured in the range 2° to 100°K. Both specimens were very pure. The results indicate that, at low temperatures at least, the lattice waves are not scattered by the conduction electrons, but that their mean free path is limited either by the size of the specimen (for the germanium) or by the crystallite size (for the silicon)."

537.311.33 : 546.28 **749**

Electron Spin Resonance of an Impurity Level in Silicon.—A. Honig & A. F. Kip. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1686–1687.) Electron spin resonance has been observed in a Si sample containing Li at a concentration of 7×10^{16} atoms/cm^3. The ionization energy of an electron in the impurity level is 0·033 eV. A single resonance line was observed over the temperature range 4°–20°K using an applied frequency of about 8·8 kMc/s and a magnetic field of about 3 200 oersted; the same line was observed at 300 Mc/s. The evidence indicates that the electron is bound to the impurity atom rather than associated with an impurity band.

537.311.33 : 546.28 **750**

Electrical Properties of Silicon containing Arsenic and Boron.—F. J. Morin & J. P. Maita. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 28–35.) Measurements were made of the conductivity and Hall constant of single-crystal specimens over the temperature range 10°–1 100°K. Analysis of the extrinsic carrier concentration values, as computed from the Hall constant, indicates the ionization energy of As donor levels to be 0·049 eV, and of B acceptor levels to be 0·045 eV for low impurity concentrations. Fermi degeneracy is found to occur in the impurity concentration range 10^{18}–10^{19} per cm^3. A formula is derived for the variation of carrier concentration with temperature up to 700°. Mobility values are computed.

537.311.33 : 546.28 **751**

Effective Masses of Holes in Silicon.—R. N. Dexter & B. Lax. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 223–224.) Cyclotron-resonance experiments are reported, the carriers being excited by infrared radiation chopped at 900 c/s. The effective mass of holes is plotted as a function of direction of magnetic field.

537.311.33 : 546.28 **752**

Effective Masses of Electrons in Silicon.—R. N. Dexter, B. Lax, A. F. Kip & G. Dresselhaus. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 222–223.) Results of cyclotron resonance experiments using optical excitation of carriers are reported. Curves are shown of the effective electron mass as a function of direction of magnetic field.

537.311.33 : 546.28 **753**

Polarization of Arsenic Nuclei in a Silicon Semiconductor.—A. Honig. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 234–235.) A mechanism capable of producing nearly 100% polarization of nuclear spins at moderate values of field strength and temperature has been found in the course of electron spin resonance studies of the type previously reported [3254 of 1954 (Fletcher et al.)].

537.311.33 : 546.289 **754**

Electron Multiplication in Germanium at Low Temperature.—E. J. Ryder, I. M. Ross & D. A. Kleinman. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1342–1343.) In response to Conwell's suggestion of an experimental check (2976 of 1954), measurements were made of the current density in a small bar of n-type Ge as a function of electric field strength at several temperatures in the range 12·1°–300°K. The curves for the lower temperatures exhibit a steep rise over part of the field-strength range; this is interpreted as evidence of electron multiplication.

537.311.33 : 546.289 **755**

Distribution of the Mass Transported from a Collector into a Germanium Crystal by the Forming Process.—W. M. Aarons, M. Pobereskin, J. E. Gates & E. B. Dale. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, p. 1345.) Measurements were made using a radioactive isotope of Au as tracer. The Au was plated on a W needle which was used to form the crystals. Results obtained with successive lappings of the surface indicate that the concentration of the transferred Au atoms is high in a region near the surface, then falls, rises a little, and finally drops abruptly.

537.311.33 : 546.289 **756**

The Interaction of Impurity Atoms with Dislocations in Germanium.—A. D. Kurtz & S. A. Kulin. (*Acta metallurgica*, March 1954, Vol. 2, No. 2, pp. 352–354.) It is suggested that the existence of dislocations in Ge gives rise to certain specific distributions of solute atoms. Results of approximate calculations give some support to this view; the theory enables some of the electrical properties of Ge to be predicted.

537.311.33 : 546.289 **757**

Effect of Dislocations on Minority-Carrier Lifetime in Germanium.—S. S. Kulin & A. D. Kurtz. (*Acta metallurgica*, March 1954, Vol. 2, No. 2, pp. 354–356.) The density of randomly distributed dislocations in Ge, as determined by two independent methods, varies between 10^6 and 10^8 per cm^2. The lifetime of minority carriers decreases hyperbolically as the dislocation density increases. The recombination efficiency per dislocation is about 2×10^{-3} per cm per sec. The change in energy gap width is calculated as a function of position in relation to a dislocation.

537.311.33 : 546.289 **758**

New Minority-Carrier Phenomenon in Germanium.—S. J. Angello & T. E. Ebert. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 221–222.) An experiment is described in which minority carriers were withdrawn from a bar of *n*-type Ge at an In-alloyed junction biased in the high-resistance direction, and the deficit was propagated along the bar by means of an electric field. The effect is the inverse of that described by Haynes & Shockley (2109 of 1949).

537.311.33 : 546.289 **759**

Injection Breakdown in Iron-Doped Germanium Diodes.—W. W. Tyler. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 226–227.) Brief description of an experiment providing evidence of hole traps in high-resistivity *n*-type Fe-doped Ge.

537.311.33 : 546.289 **760**

Properties of Zinc-, Copper-, and Platinum-Doped Germanium.—W. C. Dunlap, Jr. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 40–45.) Measurements of Hall constant and resistivity over the temperature range 15°–400°K indicate that Zn, Cu and Pt are all acceptors, with ionization energies of 0·029, 0·036 and 0·040 eV respectively. The temperature variation observed could be due to (*a*) surface conductivity with low activation energy, (*b*) traces of low-ionization-energy acceptors, or (*c*) internal leakage due to imperfections or dislocations. Evidence was found of a Pt acceptor level 0·2 eV below the conduction band and of a Cu acceptor level just below the middle of the forbidden band.

537.311.33 : 546.289 **761**

Thermal Effects on Lifetime of Minority Carriers in Germanium.—R. A. Logan & M. Schwartz. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, p. 46.) Practical precautions are described which enable Ge to be heated to temperatures as high as 875°C without causing a decrease in the lifetime of the minority carriers.

537.311.33 : 546.289 **762**

Precision Wavelength and Isotopic Shift Measurements of Germanium Arc Lines.—G. V. Deverall, K. W. Meissner & G. J. Zissis. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1463–1468.)

537.311.33 : 546.623.86 **763**

Some Electrical Properties of AlSb.—W. Sasaki, N. Sakamoto & M. Kuno. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, p. 650.) Measurements of resistivity, Hall constant and thermoelectric power as a function of temperature are reported.

537.311.33 : [546.682.86 + 546.682.19 **764**

Anomalous Optical Behavior of InSb and InAs.—H. J. Hrostowski, G. H. Wheatley & W. F. Flood, Jr. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1683–1684.) Observations have been made of the room-temperature transmission spectra of degenerate *n*-type InSb samples doped so as to have different values of electron concentration. The absorption edge is displaced to shorter wavelengths as the electron concentration is increased. The variation of the energy gap E_0 with electron concentration is compared with the curve obtained by calculation from the data of Tanenbaum & Maita (758 of 1954). Similar but smaller effects have been observed with InAs. The results indicate that the anomalous variation of E_0 is unlikely to be due to a specific impurity.

537.311.33 : 546.682.86 **765**

Neutron Irradiation of Indium Antimonide.—J. W. Cleland & J. H. Crawford, Jr. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1177–1182.) Measurements were made of Hall coefficient and resistivity of *n*-type and *p*-type single crystals of InSb after exposure to neutron irradiation. The results indicate that bombardment by fast neutrons converts *p*-type material to *n*-type and produces shallow electron traps in *n*-type material. Reduction of carrier mobility and changes of carrier concentration resulting from the bombardment can be removed by heat treatment.

537.311.33 : 546.817.241 **766**

Preparation and Properties of Lead Telluride.—E. L. Brady. (*J. electrochem. Soc.*, Sept. 1954, Vol. 101, No. 9, pp. 466–473.) "Single crystals of lead telluride, PbTe, have been prepared and their resistivity and Hall coefficients determined. Both *n*- and *p*-type lead telluride have been produced, but they were not of high resistivity. Charge carrier concentration in every case has been $1–5 \times 10^{18}/\text{cm}^3$. Hall mobility of *n*- and *p*-type carriers was found to be about 2 240 and 860 cm^2/volt-sec, respectively. Material of *p*-type was converted to *n*-type by allowing lead to diffuse into the crystal at 500°C. The value of the diffusion coefficient of Pb in PbTe at this temperature is estimated to lie between $5{\cdot}6 \times 10^{-8}$ and $9{\cdot}2 \times 10^{-8}$ cm^2/sec."

537.311.33 : 546.817.241 : 539.234 : 535.3 **767**

Optical Properties of Lead Telluride.—M. E. Lasser & H. Levinstein. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 47–52.) Evaporated films were prepared having a density about 10% less than that of the bulk material. The optical constants were calculated from curves of reflection and transmission plotted against λ. Addition of oxygen caused an increase in absorption and a slight increase in refractive index; the optical properties were then strongly dependent on the film temperature. A possible explanation of the results is presented.

537.311.33 : 621.314.63 **768**

Influence of Recombination at Contact on the Volt/Ampère Characteristics of a Rectifier.—A. V. Rzhanov. (*C. R. Acad. Sci. U.R.S.S.*, 21st Sept. 1954, Vol. 98, No. 3, pp. 389–390. In Russian.) An expression is derived for the current flowing in an *n*-type semiconductor bounded on one side by *p*-type material and on the other by a non-active contact. The electron flow across the *p-n* junction is neglected. Surface recombination takes place at the other boundary. If the thickness of the semiconductor is small compared with the diffusion path of holes, and the velocity of surface recombination is large, then the effect of recombination is to increase the saturation current. This result is derived on the assumption of a concentration of holes which is small in comparison with the equilibrium concentration of electrons, i.e. applies to reverse and small direct currents through the rectifier. An expression for the current in the case of large hole concentrations is also given.

537.311.33 : 621.314.63 **769**

Theory of Rectification at a Metal/Semiconductor Contact.—W. Schultz. (*Z. Phys.*, 18th Sept. 1954, Vol. 138, No. 5, pp. 598–612.) A study is made particularly of the influence of the inversion layer. The analysis is presented for an excess semiconductor, but corresponding arguments hold for a defect semiconductor. On making simplifying assumptions which are generally valid for semiconductors with high mobility and long diffusion path, the rectification process can be described using diode theory for the electron current and

Shockley's theory of *p-n* junctions for the hole current. An expression is derived for the blocking-layer capacitance as a function of bias voltage and of a parameter V which varies slightly with the bias. The temperature dependence of V is discussed.

537.211.33 : 621.314.632 **770**

Theory of Contact Phenomena.—G. M. Abak'yants. (*Zh. eksp. teor. Fiz.*, Sept. 1954, Vol. 27, No. 3(9), pp. 333–346.) This theory of metal-semiconductor contacts takes into account the change of the mean kinetic energy ('heating') of electrons in an electric field. The contact resistance, at constant current, is calculated for both Schottky- and Davydov-type layers. In a discussion of a note by Burgess (2697 of 1953) it is pointed out that the Einstein equation does not apply and the diffusion coefficient D is approximately proportional to the product of the mobility and the mean energy of the electrons in the electric field. The expression for drift velocity should take into account the difference between the temperature of the electrons and the lattice, which gives rise to thermal currents, and also the effect of a nonuniform electric field in the contact region. Krömer's paper (2821 of 1953) is also briefly commented on.

537.311.33 : 621.314.632 **771**

Flow of Electrons and Holes through the Surface-Barrier Region in Point-Contact Rectification.—M. Cutler. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 255–259.) Equations are derived for emission-controlled flow, taking account of non-equilibrium concentration of carriers on the semiconductor side of the barrier. A solution based on the assumption that part of the voltage drop occurs between the metal and semiconductor surfaces, rather than entirely in the barrier, leads to improved agreement between theoretical and observed current/voltage characteristics. The part played by diffusion is also discussed.

537.311.33 : 621.396.822 **772**

Some Notes on Gisolf's Theory of Electron Fluctuation Phenomena in Semiconductors.—K. W. Böer. (*Ann. Phys., Lpz.*, 15th Sept. 1954, Vol. 15, No. 1, pp. 55–56.) Correction to paper abstracted in 2139 of 1954.

537.529 : 621.315.61 **773**

The Statistical Time Lag of the Dielectric Breakdown of Mica, Glass and KC1.—H. Kawamura, H. Ohkura & T. Kikuchi. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, pp. 541–545.) Results of pulse measurements indicate that the statistical time lag at 10% overvoltage is up to 10^{-4} sec for mica but $\not> 10^{-7}$ sec for glass and KC1. Theories of the breakdown mechanism are discussed in the light of these figures.

538.221 **774**

Ferromagnetism of Certain Manganese-Rich Alloys.—E. R. Morgan. (*J. Metals, N.Y.*, Sept. 1954, Vol. 6, No. 9, Section 1, pp. 983–988.) Report of an investigation of a series of alloys based on the composition $(MnX)_4C$, where X is a metallic element which has both a positive size factor with respect to Mn and a high positive valence, e.g. Al, In and Sn. Measurements indicate that the effective magnetic moment of Mn in the alloys is at least 1·0 Bohr magneton per atom.

538.221 **775**

Study of Strip Ferronickels around the Curie Point, using Weak Alternating Fields.—A. Marais. (*C. R. Acad. Sci., Paris*, 11th Oct. 1954, Vol. 239, No. 15, pp. 873–875.) Curves are given showing the variation of initial permeability with temperature for some Ni-Fe-Cu alloys containing either Mo or Cr in addition. The influence of specimen thickness and duration of heat treatment is indicated.

538.221 : 537.533.8 **776**

Nickel Alloys with High Secondary Emissivity.—A. Bobenrieth, J. Millet & S. Teszner. (*C. R. Acad. Sci., Paris*, 4th Oct. 1954, Vol. 239, No. 14, pp. 794–796.) Ni-Be alloys with Be content up to 5% by weight were prepared in a h.f. oven at low pressure. Measurements of the secondary emissivity are reported on specimens with 4% and with 3% Be, using primary electron voltages between 300 and 800 V and collector voltages between 100 and 500 V. Values up to 96 were recorded for the 4% alloy and up to 45 for the 3% alloy. With secondary electron currents $\not>$ 1 mA, no signs of fatigue were observed in the 4% alloy over test periods of 8 hours. Ni-Mg alloys were prepared containing up to 1·2% Mg. The highest value of secondary emissivity obtained was 2.

538.221 : 538.632 **777**

Hall Effect in Ferromagnetics.—C. Kooi. (*Phys. Rev.*, 1st Aug. 1954, Vol. 95, No. 3, pp. 843–844.) Measurements on Si-Fe alloys are reported briefly; the results are in good agreement with values predicted theoretically by Karplus & Luttinger (698 above).

538.221 : 621.318.134 **778**

Some Properties of Nickel-Zinc Ferrites.—L. I. Rabkin & B. Sh. Epshtein. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1568–1578.) Experimental investigation is reported of the dependence of the magnetic properties of ferrites with mean permeabilities ranging from 40 to 2 500 on the frequency of the magnetic field (up to > 10 Mc/s), temperature between about −80°C and the Curie points (lying between 250°C and 80°C), and field strength up to ∼ 1 oersted. The permeability and losses in weak pulsed fields and the dielectric properties were also investigated. Results are presented graphically; the code numbers denote the mean permeability in gauss/oersted.

538.221 : 621.318.134 **779**

Temperature Dependence of the Magnetic Properties of Nickel-Zinc and Copper-Zinc Ferrites.—A. I. Suchkov. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1579–1583.) Magnetic properties investigated experimentally include the saturation magnetization, saturation magnetostriction, coercive force, and initial and maximum permeabilities. Curie points of CuO-ZnO-Fe_2O_3 ferrites, of the molar compositions stated, lie between 30° and 180°C. Results are presented graphically and indicate that the general theory and the quantum theory of ferromagnetism also cover the temperature dependence of the magnetic properties of ferrites.

538.221 : 621.318.134 **780**

Neutron Diffraction Studies of a Nickel Zinc Ferrite.—V. C. Wilson & J. S. Kasper. (*Phys. Rev.*, 15th Sept. 1954, Vol. 95, No. 6, pp. 1408–1411.)

538.221 : 621.318.134.029.64/.65 **781**

On the Internal Field of the Microwave Resonance in Ferrites.—N. Tsuya. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, pp. 644–645.) A possible mechanism is proposed which may cause the additional internal field.

538.221 : 669.14.018.58 **782**

Nature of Change of Coercive Force due to Tempering of Hardened Low-Carbon Steel.—I. A. Bil'dzyukevich, Ya. M. Golovchiner & G. V. Kurdyumov. (*C. R. Acad. Sci. U.R.S.S.*, 21st Sept. 1954, Vol. 98, No. 3, pp. 385–387. In Russian.) The effect of tempering of 0·1–0·12%C steel, hardened by quenching in water from 1 100°C was investigated experimentally. Results indicate that the decrease of coercivity with increase of temperature (up to 600°C) is primarily due to the removal of strains in the steel.

538.652 **783**

Derivation of Magnetostriction and Anisotropic Energies for Hexagonal, Tetragonal, and Orthorhombic Crystals.—W. P. Mason. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 302–310.) "In order to determine the measurements necessary to characterize the anisotropic energy and the saturation magnetostriction in hexagonal cobalt, a phenomenological derivation has been given for the equations which characterize the effects. Out to fourth rank tensors, the results are the same as those for circular symmetry and it requires two constants to specify the anisotropic energy and four to specify the magnetostriction. When sixth rank tensors are evaluated, a characteristic hexagonal symmetry appears. It requires four constants to characterize the anisotropic energy and nine to characterize the magnetostriction. These constants can be measured by using two oriented slabs. Four of the constants can be determined by measurements parallel to the saturation magnetization, four when the magnetostriction is perpendicular to the magnetization and one when they are 45° apart. In the appendix the first approximations for the magnetostrictive and anisotropy energies are derived for tetragonal and orthorhombic crystals."

538.652 **784**

Magnetostriction and Crystal Anisotropy of Single Crystals of Hexagonal Cobalt.—R. M. Bozorth. (*Phys. Rev.*, 15th Oct. 1954, Vol. 96, No. 2, pp. 311–316.) Measurements at field strengths up to 25 000 oersted are reported. Results are discussed in terms of theory developed by Mason (783 above). A volume contraction associated with domain orientation was observed, its value being as great as 26×10^{-6} for the most effective direction of magnetization. Superposed on this contraction is an isotropic increase of volume of $0{\cdot}6 \times 10^{-9}$ per oersted.

538.652 : 538.221 **785**

The Magnetostriction Constants of Silicon Steel: Part 1.—H. Takaki & Y. Nakamura. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, pp. 507–511.) Magnetization measurements using a ballistic method and magnetostriction measurements using a mechano-optical method were made on long single-crystal specimens of 0·7% and 1·8% Si steel; the magnetostriction constants λ_{100} and λ_{111} and the crystal-anisotropy constant K_1 were hence determined. The results confirm that these three constants decrease as the Si content increases.

538.652 : 538.221 **786**

Temperature Dependence of Magnetostriction of Ferromagnetic Alloys.—D. I. Volkov & V. I. Chechernikov. (*Zh. eksp. teor. Fiz.*, Aug. 1954, Vol. 27, No. 2(8), pp. 208–214.) The saturation-magnetostriction/temperature characteristics of Ni-Cu, Ni-Mn, and Ni-Fe alloys were determined by means of a tensometer method at temperatures up to the Curie point. Results, which are presented graphically, are in good agreement with theory.

539.23 : 537.311.3 **787**

Resistance of Thin Metal Films at High Frequency and Low Temperature.—S. Offret & B. Vodar. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1027–1029.) Results of measurements indicate that short-circuiting by intergranular capacitances is probably responsible for the decrease of resistance at high frequency and for the increase in the algebraic value of the temperature coefficient of resistance. At sufficiently high frequencies it should be possible to measure the resistance of the metal grains themselves.

621.315.613.1 **788**

Synthetic Mica Investigations: Part 5—A Low-Shrinkage Machinable Ceramic of Phosphate-Bonded Synthetic Mica.—J. E. Comeforo. (*J. Amer. ceram. Soc.*, 1st Sept. 1954, Vol. 37, No. 9, pp. 427–432.) Total shrinkage is easily maintained at $< 3\%$ with a material formed by pressing powdered synthetic mica with phosphoric acid as a binding agent. The dielectric properties approximate to those reported [784 of 1954 (Comeforo et al.)] for hot-pressed phosphate-free material of similar porosity. Loss factor is 1–2% at room temperature and 4–8% at 300°C at a frequency of 1 Mc/s. The material is suggested as a substitute for natural block talc.

621.315.616 : 537.533.9 **789**

Irradiated Polyethylene.—J. B. Campbell. (*Mater. & Meth.*, Sept. 1954, Vol. 40, No. 3, pp. 91–95.) The effect on polyethylene of bombardment by high-voltage electrons is described; details are given of commercially available material in tape form. Unlike ordinary polyethylene, the irradiated material is not thermoplastic; its use may permit reduction in size of electrical equipment operating at high temperatures. Dielectric strength at high temperature may be improved by the treatment.

621.372.412 : 549.514.51 **790**

Effect of Acoustic Impedance and Viscosity of Gases on the Electrical Constants of Quartz.—S. Parthasarathy & V. Narasimhan. (*Ann. Phys., Lpz.*, 15th Sept. 1954, Vol. 15, No. 1, pp. 6–14. In English.) Experimental results show that the equivalent electrical resistance of a quartz crystal is proportional to the acoustic impedance of the gas in which it is vibrating; the Q factor decreases exponentially with increasing viscosity, as in liquids, but the relation is approximately linear over the small range involved. The natural frequency of the crystal used was 414·216 kc/s.

621.39 : 621.791.3 **791**

Investigations on Soldered Joints.—H. Künzler & H. Bohren. (*Tech. Mitt. schweiz. Telegr.-Teleph Verw.*, 1st Sept. 1954, Vol. 32, No. 9, pp. 329–351. In German.) Chemical and physico-chemical problems are discussed. Tests were made to find a solder with a noncorrosive flux. The influence of temperature on the structure of soldered materials and the quality of the joints was studied. The wear of Cu soldering irons is much reduced if the solder contains some Cu.

666 : 539.61 : 669 **792**

Frictional Adhesion of Metal to Glass, Quartz, and Ceramic Surfaces.—R. B. Belser. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 862–864.) Experiments were made using small disks of various metals rotated at high speed in contact with the various insulator surfaces; by suitably adjusting speeds and pressures a layer of metal was made to adhere securely. The process may be useful for making glass-to-metal joints and electrically conducting lines, and for glass cutting.

MATHEMATICS

512.393 **793**

Solutions of Cubics and Quartics.—G. Millington: A. C. Sim. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, p. 30.) Comment on 187 of January and author's reply. An error in the original paper is corrected.

519.281 **794**

Method of Averages and its Comparison with the Method of Least Squares.—M. Morduchow. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1260–1263.) Comparison of the two methods is illustrated by treating the problem of fitting a straight line to a number of points. It is shown that the standard deviation of the residuals by the method of averages is at most $2/\sqrt{3}$ times as great as that by the method of least squares.

517.9 **795**

Relaxation Methods. [Book Review]—D. N. de G. Allen. Publishers: McGraw-Hill, New York and London, 1954, 257 pp., $7.50. (*Science*, 10th Sept. 1954, Vol. 120, No. 3115, pp. 423–424.) A strongly recommended textbook, giving descriptions of the basic operations and their application.

MEASUREMENTS AND TEST GEAR

53.088 **796**

Sensitivity—a Criterion for the Comparison of Methods of Test.—J. Mandel & R. D. Stiehler. (*J. Res. nat. Bur. Stand.*, Sept. 1954, Vol. 53, No. 3, pp. 155–159.) "If M is a measure of some property Q, and σ_M its standard deviation, the sensitivity of M, denoted ψ_M is defined by the relation $\psi_M = (\mathrm{d}M/\mathrm{d}Q)/\sigma_M$. It follows from this definition that the sensitivity of a test method may or may not be constant for all values of the property Q. A statistical test of significance is derived for the ratio of sensitivities of alternative methods of test. Unlike the standard deviation and the coefficient of variation, sensitivity is a measure of merit that is invariant with respect to any functional transformation of the measurement, and is therefore independent of the scale in which the measurement is expressed."

621.316.842 (083.74) **797**

Recent Development of Standard Resistors.—A. Schulze. (*Elektrotech. Z., Edn A*, 1st Sept. 1954, Vol. 75, No. 17, pp. 547–550.) The construction and manufacture of sealed-in standard resistors is described. The temperature coefficient of resistance has been reduced to 1×10^{-6} in 97·95 Au/2·05 Cr alloy resistors by heat pre-treatment, and to 10×10^{-6} in manganin-wire resistors. The change of resistance of the Au/Cr standards is of the order of 1×10^{-5} over a period of 3–5 years.

621.317.3.029.63 + 534.62 **798**

Construction of a Reflection-Free Room for Sound Waves and Decimetre Electrical Waves.—Epprecht, Kurtze & Lauber. (See 612.)

621.317.33 **799**

A Two-E.M.F. Method for the Comparison of Resistances.—H. J. Hoge. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 902–907.) Two sources of e.m.f., each with an associated dropping resistor, are respectively connected in series with two resistors to be compared in such a way that the latter are not adjacent; the circuit is adjusted so that the potentials at the corresponding ends of the two resistors are equal when they carry equal currents. The method permits continuous observation or recording without error due to uncontrolled change of resistance in the connections.

621.317.333.6 : 621.372.8 **800**

Electrical Breakdown in Waveguides at 3 000 Mc/s.—Sutherland. (See 640.)

621.317.335 **801**

Measurement of Permittivity and Tangent of Loss Angle of Dielectrics with High Absorption at Centimetre Wavelengths.—E. Briganti. (*Poste e Telecomunicazioni*, July 1954, Vol. 22, No. 7, pp. 327–332.) A cavity-resonator method suitable for liquid specimens is described. Rigorous but simple formulae are derived for determining the permittivity and loss angle from measurements of wavelength and power.

621.317.337 : 621.372.413 **802**

Nomogram for Q of a Cavity.—J. D. Harmer. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, pp. 25–27.) A nomogram is presented with the aid of which the Q factor can be determined from a small number of measurements of the standing waves in a feeder coupled to the cavity.

621.317.41/.42 : 621.395.625.3 **803**

Experimental Determination of [magnetic] **Parameters of Magnetic-Recording Media.**—G. S. Veksler & P. S. Tomashevski. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1594–1598.) Description, with circuit diagram, of c.r.o. apparatus for tracing $4\pi I/H$ curves at frequencies up to $> 10^4$ c/s. Photographs of typical hysteresis loops are presented including one showing also the initial part of the curve.

621.317.7 : 621.396.822 : 621.385 **804**

A Multichannel Noise Spectrum Analyzer for 10–10 000 c/s.—E. G. Nielsen & A. van der Ziel. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 899–902.) An instrument for rapid analysis of flicker noise in valves is described. Values of either the equivalent saturated diode current or the equivalent noise resistance at 10, 30, 100, 300, 1 000, 3 000 and 10 000 c/s are obtained simultaneously by feeding the signal into seven parallel channels each incorporating a wide-band RC filter and a thermistor square-law detector.

621.317.715 : 621.375.13.029.424 **805**

A Tuned Galvanometer Amplifier.—J. R. Beattie & G. K. T. Conn. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 888–891.) Description of a system consisting of a galvanometer tunable by feedback over the range 1–3 c/s, followed by an electronic amplifier covering the same frequency range (2950 of 1953), for amplifying signals from a radiation thermocouple used with a low-frequency interrupter. The output is presented as a rectified smoothed meter deflection. The amplification is sufficient to reveal thermal noise in the thermocouple circuit.

621.317.73 **806**

A Goniometer Quotient-Measurement Method for the Direct Determination of Admittance.—H. Fricke. (*Funk u. Ton*, May & July 1954, Vol. 8, Nos. 5 & 7, pp. 225–238 & 369–377.) Voltages proportional respectively to the current through the unknown impedance and the voltage across it are applied to the crossed coils of a goniometer, phase equalization being effected by a tuned circuit or a short-circuited transmission line across the unknown impedance. Calibration curves for 1-Mc/s operation are given; error can be kept within a given limit, say 1%, over different ranges by adjustment of series resistance and goniometer coupling; sensitivity is improved by a two-goniometer system. Circuits and goniometer arrangement for operation at u.h.f. are described. A possible application of the equipment with a c.r.o. for displaying locus curves is outlined.

621.317.733 **807**

Modern Bridge Techniques.—P. M. Ratcliffe. (*Marconi Instrumentation*, Sept. 1954, Vol. 4, No. 7, pp. 167–175.) A concise review.

621.317.733 : 621.316.86 : 537.312.6 **808**

A Self-Balancing Thermistor Bridge.—A. F. Standing. (*J. sci. Instrum.*, Sept. 1954, Vol. 31, No. 9, pp. 343–344.) A direct reading of power in the range 0·1–10 mW is obtained by including the thermistor in an oscillatory feedback circuit such that the thermistor resistance is held constant. The oscillator output is balanced against a direct voltage to give a zero meter reading in the absence of r.f. power.

621.317.74 : 621.315.212 **809**

R. F. Cable Characteristics measured with a *Q*-Meter.—J. Shekel. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 540–542.) Theory and practical details are given for a method in which a *Q*-meter determination of the frequency at which a section of the cable becomes a $\lambda/2$ resonator enables the propagation velocity, the characteristic impedance and the attenuation of the cable to be computed. A numerical example is included.

621.317.74 + 621.317.772] : 621.397.5 : 535.623 **810**

Differential Phase and Gain Measurements in Color-Television Systems.—Kelly. (See 871.)

621.317.742 : 621.3.018.756 **811**

Direct V.S.W.R. Readings in Pulsed R.F. Systems.—L. A. Rosenthal & G. M. Badoyannis. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 162–165.) Development of the ratio meter previously described [466 of 1953 (Rosenthal et al.)] to deal with pulse systems such as radar. Thermionic diodes are used as detectors. Pulse stretching is found necessary; a suitable circuit is shown. Operating procedure is outlined and measurements with standard and other loads are reported.

621.317.742 : 621.315.212 **812**

A Coaxial Standing-Wave Indicator for Frequencies near 10 000 Mc/s.—F. A. Benson & G. V. G. Lusher. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 534–537.) Details are given of the construction of a precision instrument.

621.317.75 : 621.396.3 **813**

Response of Radio Spectrometers to Nonperiodic Morse Signals.—J. Marique. (*Ann. Télécommun.*, July–Sept. 1954, Vol. 9, Nos. 7–9, pp. 215–223 & 247–255.) The analysis is presented for the same arrangement of cascaded tuned circuits as discussed in previous studies (e.g. 2034 of 1954); expressions are derived for the currents in these circuits. The envelope-response of the circuit is defined and the conditions are investigated for this response to be sufficiently independent of the circuit design for practical purposes.

621.317.755 **814**

Measurement of an Impedance by means of a Double-Trace Cathode-Ray Oscillograph: Coincidence Method.—A. Grumbach. (*C. R. Acad. Sci., Paris*, 11th Oct. 1954, Vol. 239, No. 15, pp. 869–871.) The unknown impedance is connected in series with a known impedance across the output terminals of a sine-wave generator, one of these terminals being earthed while the other is connected to one of the c.r.o. deflection systems. The second deflection system is connected to the junction between the impedances. The known impedance is varied to produce phase coincidence between the two curves; amplitude coincidence is produced by means of amplifiers. The sensitivity of the method is discussed in relation to measurement of the permittivity and conductivity of a capacitor dielectric. Use of the arrangement for measuring frequency is also indicated. The frequency range is up to 100 kc/s.

621.317.755 **815**

Wide-Band Amplitude Distribution Analysis of Voltage Sources.—L. W. Orr. (*Rev. sci. Instrum.*, Sept. 1954, Vol. 25, No. 9, pp. 894–898.) Signals to be analysed are applied to a c.r.o. fitted with a slotted mask through which the luminescence output is fed to a photocell, the required amplitude distribution function being displayed on a second c.r.o. The apparatus can be set up and operated quickly, and the accuracy is within 5%. Analyses of two noise sources are shown.

621.317.755 : 621.385.3/.5 **816**

Development of a Characteristic-Curve Tracer for Transmitting Valves.—J. Kammerloher & H. Krebs. (*Funk u. Ton*, Sept. 1954, Vol. 8, No. 9, pp. 453–470.) Description of a d.c.-pulse c.r.o. suitable for dealing with positive grid voltages. Circuit diagrams and some details of the switching arrangements are included. Typical curves obtained are reproduced; these include I_a/V_a curves for I_a up to 2A, V_a up to 1 000 V and grid voltages of 0, 60, .. 300 V. An a.c.-pulse instrument is briefly mentioned.

621.317.761 : 621.374.3 **817**

A Pulse-Interval Meter for measuring Pulse Repetition Frequency.—A. M. Andrew & T. D. M. Roberts. (*Electronic Engng*, Nov. & Dec. 1954, Vol. 26, Nos. 321 & 322, pp. 469–474 & 543–547.) The instrument described is suitable for use in cases such as neurophysiological measurements where the pulse repetition frequency varies rapidly. The output voltage at any instant is determined either by the duration of the preceding pulse interval, or by the duration already attained by the current interval, whichever is the longer. Frequency is indicated on an approximately linear scale, either by oscilloscope or by moving-coil meter.

621.396.001.4 **818**

Prediction of Electronic Failures.—(*Elect. J.*, 3rd Sept. 1954, Vol. 153, No. 10, pp. 717–718.) The N.B.S. experimental failure-prediction unit is based primarily on the detection of a decrease in valve transconductance in successive stages of the equipment under test, which requires slight modification to enable stages to be tested separately. Provision for checking capacitors for leakage, and for voltage and current measurements is also made.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.1-8 : 669 **819**

Metallurgical Effects of Ultrasonic Waves.—E. A. Hiedemann. (*J. acoust. Soc. Amer.*, Sept. 1954, Vol. 26, No. 5, pp. 831–842.) A survey with 121 references.

534.88 **820**

Echo-Location for the Blind.—C. M. Witcher & L. Washington, Jr. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 136–137.) Developments are described in devices of the type emitting high-frequency clicks which are reflected by obstacles. The sound projector is rotated through an angle of 60° in a period of 0·7–1 sec by means of a miniature motor. A model for attachment to clothing weighs 1¾ lb.

621.314.214.5 : 621.317.39 **821**

Differential Transformers for Mechanical Measurements.—L. W. Blick. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, pp. 603–610. Discussion, p. 611.) Circuits for use with this type of transformer are described and applications as transducers are indicated.

621.316.7 **822**

A Design Philosophy for Man-Machine Control Systems.—H. P. Birmingham & F. V. Taylor. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1748–1758.) Methods are described for designing control systems so that the human operator is required to act only as a simple amplifier. Aided tracking is discussed in relation to efforts to improve the stability of man-machine systems by the use of special equalization networks.

621.316.718 : 534.85 : 621.94 **823**

Magnetic Tape controls Machine Tools.—J. W. Hogan. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 144–147.)

621.317.39 **824**

Three Electronic Thickness Gages for Metallic Coatings.—(*Tech. News Bull. nat. Bur. Stand.*, Sept. 1954, Vol. 38, No. 9, pp. 127–132.) Three instruments are described, in all of which operation depends on the difference in electrical conductivity between the plating and the support metal. The 'dermitron' and the phase-angle thickness meter are electromagnetically coupled to the specimen and make use of the reflected field from eddy currents induced in the specimen. The 'waveguide plating quantity indicator' makes a direct measurement of conductivity, using point electrodes.

621.317.39 **825**

Wire Strain-Gauge Transducers for the Measurement of Pressure, Force, Displacement, and Acceleration.—J. L. Thompson. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, pp. 583–600. Discussion, pp. 600–601.) Construction, theory of operation, and applications are discussed.

621.317.39 **826**

Load-Cell Force Transducers.—D. L. Johnston. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, pp. 613–620. Discussion, p. 620.) A chart is presented indicating ranges of power level and conversion efficiency for various types of transducer; the strain-gauge load-cell type is particularly useful for dealing with large forces. Associated measuring circuits are discussed.

621.317.79 : 621.385 : 531.717.3 **827**

Electronic-Mechanical Transducers.—L. A. Goncharski. (*Zh. tekh. Fiz.*, Sept. 1954, Vol. 24, No. 9, pp. 1711–1723.) Theory and practical considerations are discussed of a sensitive electron-tube-type transducer consisting basically of a thin, electrically heated filament between a pair of plate electrodes one of which is operated as anode. The two plates are rigidly attached by through leads to a glass pinch, flexibly sealed in the container wall, which picks up the displacements to be measured. Using a constant anode current of 1·5 mA, with > 90 V on the anode and -10 V on the other plate, the voltage sensitivity is $\sim 6\,000$ V per cm displacement of the plates. The current sensitivity is of the order of 0·1 A/cm-displacement. References to previous papers on the applications of this transducer are given.

621.365.55 : 674 **828**

Electronic Heating and the Woodworking Industry.—M. T. Elvy. (*J. Brit. Instn Radio Engrs*, Nov. 1954, Vol. 14, No. 11, pp. 547–566. Discussion, p. 567.) A review of h.f. dielectric heating methods with particular reference to the use of synthetic resin glues. The design of oscillation generators and coupling systems, jigs and electrodes is discussed.

621.384.612 **829**

Suppression of Coherent Radiation by Electrons in a Synchrotron.—J. S. Nodvick & D. S. Saxon. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 180–184.)

621.384.612 **830**

Phase Oscillations in the Strong-Focusing Synchrotron.—E. Bodenstedt. (*Ann. Phys., Lpz.*, 15th Sept. 1954, Vol. 15, No. 1, pp. 35–54.) Phenomena connected with the acceleration of particles beyond the critical-energy region in the strong-focusing synchrotron [1454 of 1953 (Courant et al.)] were investigated using a mechanical analogue machine. Acceleration of particles beyond the critical energy can be accomplished by means of an odd number of jumps of the oscillator phase or by modulation of the oscillator voltage.

621.384.612 **831**

Project for an Electron Synchrotron in Italy.—G. Salvini. (*Nuovo Cim.*, 1954, Supplement to Vol. 12, No. 1, pp. 77–100.) Plans are discussed in some detail for a 600-MeV machine to be available for all nuclear physics work in Italy; the desirability of raising the energy to 1 000 MeV is indicated.

621.384.612 **832**

Amplitudes of Oscillations in the Strong-Focusing Synchrotron.—J. Seiden. (*C. R. Acad. Sci., Paris*, 4th Oct. 1954, Vol. 239, No. 14, pp. 798–800.) Simple formulae are presented.

621.384.612 **833**

Effects on Orbits of Correlation between Lens Alignment Faults in the Synchrotron.—J. Seiden. (*C. R. Acad. Sci., Paris*, 18th Oct. 1954, Vol. 239, No. 16, pp. 966–968.)

621.384.622.1 : 537.533.9 **834**

Applications of High-Energy Electrons to the Sterilization of Pharmaceuticals and the Irradiation of Plastics.—C. W. Miller. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, pp. 637–652. Discussion, p. 652.) For irradiating the materials discussed the available energy can be used more efficiently by electron bombardment than by X rays or γ rays. The required high-energy electrons should be obtained from a linear accelerator rather than a radioactive source. Practical and economic aspects of the use of linear accelerators are discussed. Over 50 references.

621.384.622.2 **835**

A Theory of Electron-Beam Loading in Linear Accelerators.—G. Saxon. (*Proc. phys. Soc.*, 1st Sept. 1954, Vol. 67, No. 417B, pp. 705–716.) Analysis is presented for the waveguide circuit of a linear accelerator using r.f. power feedback, to determine how the power flowing into such an accelerator varies with the beam loading. The relations derived are used in conjunction with formulae for the energy gain and beam power output of a length of accelerator waveguide to calculate the performance to be expected under feedback conditions as the beam current is varied. The calculated results are in reasonable agreement with measurements.

621.385.833 **836**

The Application and Limitations of the Edge-Diffraction Test for Astigmatism in the Electron Microscope.—M. E. Haine & T. Mulvey. (*J. sci. Instrum.*, Sept. 1954, Vol. 31, No. 9, pp. 326–332.)

621.385.833 **837**

Rigorous Calculation for a Typical Electrostatic Unipotential Lens.—W. Glaser & P. Schiske. (*Optik, Stuttgart*, 1954, Vol. 11, Nos. 9 & 10, pp. 422–443 & 445–467.)

621.385.833 **838**

Centering of Magnetic Electron Lenses.—S. Leisegang. (*Optik, Stuttgart*, 1954, Vol. 11, No. 9, pp. 397–406.)

621.387.4 **839**

The Reliability of Nucleonic Instruments.—D. Taylor. (*J. Brit. Instn Radio Engrs*, Nov. 1954, Vol. 14, No. 11, pp. 570–580. Discussion, p. 580.) The servicing of nucleonic instruments under factory conditions is discussed; problems encountered in the British Atomic Energy Project are considered. Annual failure rates of some of the standard instruments are given; these are highest for the more orthodox components, such as valves and resistors. U.S. and Canadian figures are also quoted. Design principles are derived from the analyses presented.

621.387.424 **840**

Secondary Electron Emission by Photoelectric Action and Ion Bombardment at the Cathode in Corona Breakdown of Argon.—L. Colli & U. Facchini. (*Phys. Rev.*, 1st Oct. 1954, Vol. 96, No. 1, pp. 1–4.) Discussion of secondary-emission mechanisms in cylindrical argon-filled counter tubes with positive axial wire.

621.398.029.62 : 525.6 **841**

Radio-Linked Unattended Tide Gauge for Persian Gulf.—(*Engineer, Lond.*, 27th Aug. 1954, Vol. 198, No. 5144, p. 305.) A 27-W v.h.f. transmitter is keyed by a series of half-second pulses generated by a balance wheel system; the number of pulses is controlled by a plunger system operated by a tide drum and gives a coded indication of tide height over a range − 1 to + 13 ft. The transmitter is supplied by NiFe cells charged automatically. The output of a receiver 12 miles away is fed to an integrator which operates an indicator scaled in divisions of 0·1 ft.

PROPAGATION OF WAVES

538.566 : 551.510.535 **842**

Focusing Phenomena due to Undulations of the Ionosphere, and Determination of Collision Number.—K. Rawer & É. Argence. (*C. R. Acad. Sci., Paris*, 27th Oct. 1954, Vol. 239, No. 17, pp. 1066–1067.) An approximate formula is given for the amplitude of echoes for a reflecting surface with sinusoidal undulations. The effect of the curvature becomes preponderant near the focus state $r = ph_0$, where r is the radius of curvature, p the order of the echo, and h_0 the height of the ionized layer. The parameters involved can be calculated from the amplitudes of three successive echoes, most conveniently observed at night. The curvature effect is useful for re-interpreting old observations giving reflection coefficients greater than unity. Adopting the hypothesis that collisions are mostly between electrons and neutral molecules, a collision number of about 400 is found for the middle of the F_2 layer during winter nights.

621.396.11 + 621.396.9 + 523.16 **843**

Propagation of Electromagnetic Waves, Radio Location and Radio Astronomy.—E. Roessler. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 632–635.) A brief survey of recent progress, particularly since 1951. 73 references.

621.396.11 : 551.510.5 **844**

Central Radio Propagation Laboratory of the N.B.S.—(*Engineer, Lond.*, 17th Sept. 1954, Vol. 198, No. 5147, pp. 401–404.) See 3018 of 1954.

621.396.11.029.62 : 551.51 **845**

A Study of Some of the Meteorological Effects on Radio Propagation at 96·3 Mc/s between Richmond, Va, and Washington, D.C.—D. L. Randall. (*Bull. Amer. met. Soc.*, Feb. 1954, Vol. 35, No. 2, pp. 56–59.) "For meteorological observations during which the wind speeds were equal to or greater than 10 m.p.h., and when fronts, low overcast clouds (less than 5 000 ft), rain, thunderstorms and fogs were excluded, a 0·70 correlation coefficient was found between hourly surface refractive index and hourly median field strength."

621.396.81 **846**

Theoretical Field Strengths and Angles of Incidence of WWV Transmissions at the Châtonnaye Receiving Station.—C. Glinz. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st July 1954, Vol. 32, No. 7, pp. 253–267. In German.) German version of paper abstracted in 3668 of 1954.

621.396.81 **847**

Some Observations on Rayleigh Fading.—B. van der Pol. (*Tijdschr. ned. Radiogenoot.*, Sept. 1954, Vol. 19, No. 5, pp. 223–229. In English.) Fading due to multipath propagation is discussed on the basis of the random-walk problem. A formula is presented from which (*a*) the most probable, (*b*) the median, and (*c*) the mean signal amplitude is evaluated. The method of obtaining the Rayleigh distribution curve from a typical fading record is shown. The distinction between Rayleigh fading and fading due to variation of ionospheric absorption is emphasized.

621.396.812.3.029.53 : 551.510.535 **848**

Periodic Fading of Medium-Wave Radio Signals.—Rao & Sarma. (See 714.)

RECEPTION

621.376.232.2.015.7 **849**

Pulse Response of Signal Rectifiers.—M. V. Callendar. (*Wireless Engr*, Jan. 1955, Vol. 32, No. 1, pp. 3–14.) An examination is made of the loading imposed by a diode rectifier on a tuned circuit from which it is fed. The response time for the circuit together with the diode is investigated, both directly and via the modulation-frequency response characteristic. Measurements are reported confirming the theory for the simplest case of a single circuit centrally tuned and yielding information on the response with more complex wide-band amplifiers. Comparison is made with the performance of a triode detector. The most important practical conclusion is that no advantage is gained by using a shunt resistor across the circuit to provide damping.

621.396.62(43) **850**

New German Broadcast Receivers.—O. Limann. (*Elektrotech. Z., Edn B*, 21st Sept. 1954, Vol. 6, No. 9, pp. 347–351.) Improved sensitivity, selectivity and fidelity are features of the 1954 models. The triode Type-ECC85 is used almost universally as low-noise u.s.w. first-stage valve; the medium-slope Type-EF89 pentode has advantages for the i.f. stage. Distortion in the a.f. stages has been reduced by two-channel amplification and other methods; side loudspeakers are used in some models.

621.396.621 + 621.37] : 621.314.7 **851**

Some Transistor Circuits.—van Overbeek. (See 650.)

621.396.621.54 **852**

A.M./F.M. Communications Receiver.—(*Wireless World*, Jan. 1955, Vol. 61, No. 1, pp. 41–43.) Description and performance report of a commercial model with continuous tuning over the range 19–165 Mc/s in six bands. The i.f. is 5·2 Mc/s. R.f., oscillator and mixer stages form a single unit; the six-position rotary-coil turret, three-gang split-stator capacitors and other components are arranged so as to minimize the amount of wiring.

621.396.821 : 519.2 **853**

Study of Statistical Models suggested by Consideration of the Effects of Atmospherics on Amplifiers.—A. Blanc-Lapierre, M. Savelli & A. Tortrat. (*Ann. Télécommun.*, Sept. 1954, Vol. 9, No. 9, pp. 237–245.) An analysis is made of the output of a linear amplifier to whose input is applied (*a*) Gaussian noise with uniform spectrum, and (*b*) random pulses with a Poisson distribution in time. Consideration is given to the limiting condition when the density of the Poisson distribution is very high. A method of calculating the instantaneous amplitude distribution is developed. The case of a train of very short pulses is dealt with, and properties of the detected voltage are discussed.

621.396.621 **854**

Radio Receiver Design—Part I. [Book Review]—K. R. Sturley. Publishers: Chapman & Hall, London, 2nd edn, 667 pp., 58s. (*J. sci. Instrum.*, Sept. 1954, Vol. 31, No. 9, p. 347.) Revised and augmented to a length about 50% greater than that of the first edition. "The book should be a useful and reliable guide to those concerned with circuits for radio frequencies or with the characteristics of radio receivers."

STATIONS AND COMMUNICATION SYSTEMS

621.376.56 **855**

Experimental Model for Pulse-Number Modulation.—J. Holzer, G. Missriegler, E. Niedermayr, H. Putschi & H. Zemanek. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, Sept./Oct. 1954, Vol. 8, Nos. 9/10, pp. 125–132.) Description of equipment installed at the Technische Hochschule at Vienna. The principle of operation is to convert the l.f. signal into width-modulated pulses which are in turn converted into groups containing corresponding numbers of narrow equal-width pulses; these are counted in a binary system and the results give the code group. 32-step quantization is used. Decoding is performed by causing the received pulses to charge a capacitor which is discharged through a resistor, the time constant of the system being made equal to $t_0/\log 2$, where t_0 is the time spacing of the pulses in the code group.

621.376.56 **856**

Reception of Code-Modulation Signals by Integration.—H. Harmuth. (*Fernmeldetech. Z.*, Sept. 1954, Vol. 7, No. 9, pp. 461–464.) See 2505 of 1954.

621.39 : 621.372.8 **857**

Waveguide as a Communication Medium.—Miller. (See 641.)

621.39.001.11 **858**

1954 Symposium on Information Theory.—(*Trans. Inst. Radio Engrs*, Sept. 1954, No. PGIT-4, pp. 1–227.) The text is given of the following papers presented at the symposium held at the Massachusetts Institute of Technology in September 1954:—

- A New Basic Theorem of Information Theory (pp. 2–22).—A. Feinstein.
- Binary Coding (pp. 23–28).—M. J. E. Golay.
- Error-Free Coding (pp. 29–37).—P. Elias.
- A Class of Multiple-Error-Correcting Codes and the Decoding Scheme (pp. 38–49).—I. S. Reed.
- Coding for Constant-Data-Rate Systems (pp. 50–63).—R. A. Silverman & M. Balser.
- Information, Organization and Systems (pp. 64–66).—J. Rothstein.
- An Information-Theoretical Model of Organizations (pp. 67–75).—M. Kochen.
- Simulation of Self-Organizing Systems by Digital Computer (pp. 76–84).—B. G. Farley & W. A. Clark.
- A Study of Ergodicity and Redundancy based on Intersymbol Correlation of Finite Range (pp. 85–92).—S. Watanabe.
- Multivariate Information Transmission (pp. 93–111).—W. J. McGill.
- Choice and Coding in Information Retrieval Systems (pp. 112–118).—C. N. Mooers.
- Modern Statistical Approaches to Reception in Communication Theory (pp. 119–145).—D. Van Meter & D. Middleton.
- A Nonlinear Prediction Theory (pp. 146–162).—R. F. Drenick.
- The Detection of Signals perturbed by Scatter and Noise (pp. 163–170).—R. Price.
- The Theory of Signal Detectability (pp. 171–212).—W. W. Peterson, T. G. Birdsall & W. C. Fox.
- The Human Use of Information: Part 1—Signal Detection for the Case of the Signal Known Exactly (pp. 213–221).—W. P. Tanner, Jr, & J. A. Swets.
- The Human Use of Information: Part 2—Signal Detection for the Case of an Unknown Signal Parameter (pp. 222–227).—W. P. Tanner, Jr, & R. Z. Norman.

621.39.001.11 **859**

Note on a Theorem of Shannon.—S. De Francesco. (*Ann. Geofis.*, April 1954, Vol. 7, No. 2, pp. 195–207.) The formula given in Shannon's 'sampling theorem' (1649 of 1949) is shown to correspond to complete convergence of a generalized Fourier-series expansion. An expression is derived for the inherent error.

621.395.44 : 621.375.2 **860**

Line Amplifiers for Symmetrical Carrier-Frequency Cables.—F. Feil. (*Fernmeldetech. Z.*, Sept. 1954, Vol. 7, No. 9, pp. 454–460.) Amplifier types V12, V60 and V120 for the German Post Office system are described. As a result of advances in design, the V120 is smaller and consumes less power than the V12. A comparison table of the most important data is presented.

621.396.3 **861**

Predicted-Wave Radio Teleprinter.—M. L. Doelz. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 166–169.) The 'predicted-wave' system is a particular form of frequency-shift. The detection circuits accumulate over each pulse period the signal and noise from each of the two frequency channels in high-Q magnetostrictive resonators; a mark or a space is registered according as the accumulated amplitude is greater in the mark channel or in the space channel. A synchronizing signal is transmitted on a frequency of 23·04 kc/s, midway between mark and space frequencies. Performance figures are given; an error rate of 0·1% was obtained with signals 6 db below noise level in the i.f. band; this constitutes a considerable improvement over the performance of a conventional frequency-shift system.

621.396.3 : 621.317.75 **862**

Response of Radio Spectrometers to Nonperiodic Morse Signals.—Marique. (See 813.)

621.396.712 + 621.397.743 **863**

Plans for F.M.-Radio and Television Networks in Denmark.—G. Pedersen. (*Teleteknik, Copenhagen*, July 1954, Vol. 5, No. 2, pp. 220–230.)

621.396.932 **864**

Radio Communication in the Merchant Marine.—W. E. Steidle. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 584–587.) A brief account is given of the use made of the several frequency bands allocated to shipping, and of modern radio equipment used at sea.

621.39.001.11 **865**

Information Theory. [Book Review]—S. Goldman. Publishers: Syracuse University, Prentice-Hall Inc., 1953, 385 pp., $9.00. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 360–362.) Intended for graduate students in electrical engineering. The treatment is based on Shannon's work; liberal use is made of examples.

SUBSIDIARY APPARATUS

621.314.63:546.28 **866**

Silicon Power Rectifier handles 1 200 Watts.—E. F. Losco. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 157–159.) A *p-n* fused-junction Si-Al rectifier with a junction area of 0·05 cm² is mounted in a copper radiator with a slotted periphery. High power-handling capacity is obtained by use of forced-air cooling. Characteristic curves are shown.

621.316.722 **867**

Direct-Voltage Stabilizers in the Range 10–100 kV with Particular Reference to Degenerative Systems.—M. W. Jervis. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, pp. 629–636.) The maximum usable loop gain depends on the frequency response of the system; in practice, loop gains of the order of 1 000 are possible, i.e. the effects of mains-voltage and load-current fluctuations are reduced by this factor. Reference elements are reviewed; wire-wound resistance potential dividers are the most stable, but electron-energy analysers give comparable stability with smaller size and current drain.

621.316.722.1 **868**

A 2 kVA A.C. Voltage Stabilizer.—R. G. Ackland. (*Aust. J. Instrum. Tech.*, Aug. 1954, Vol. 10, No. 3, pp. 98–101.) A motor-operated variac type of stabilizer is described, in which the voltage-sensing unit contains only one valve, of cold-cathode type, and incorporates biasing to hold the output voltage near the centre of the control range. The output is maintained at 230 V ± 1% (or ± 1 V if required). The correction rate is 10 V/sec.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 **869**

Television Engineering [in Western Germany].—F. Kirschstein. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 638–640.) Brief survey of studio and industrial techniques, transmitters, receivers and microwave and cable links. 55 references.

621.397.5 : 061.3 **870**

Technical Conference of West German Broadcasting Authorities held at Munich, 24th–28th May 1954.—(*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 7/8, pp. 149–176.) Summaries are given of 29 papers dealing with various aspects of television. Subjects include transmission, studio equipment and techniques, television links, and measuring equipment.

621.397.5 : 535.623 : [621.317.74 + 621.317.772 **871**

Differential Phase and Gain Measurements in Color-Television Systems.—H. P. Kelly. (*Elect. Engng, N.Y.*, Sept. 1954, Vol. 73, No. 9, pp. 799–802.) Portable apparatus suitable for colour-carrier-frequency measurements in N.T.S.C. systems is described with the aid of block diagrams. Simplified circuit diagrams are also given of sections of the test transmitter and receiver.

621.397.5 : 535.767 **872**

Stereo-Television.—H. Dewhurst. (*J. Telev. Soc.*, July/Sept. 1954, Vol. 7, No. 7, pp. 279–285.) A review of possible methods. Only those involving viewer aids appear to be practicable. 33 references.

621.397.61 **873**

An Experimental Camera Circuit for 405 Lines.—C. H. Banthorpe. (*J. Telev. Soc.*, July/Sept. 1954, Vol. 7, No. 7, pp. 300–303.) A simple camera for scanning still pictures and captions makes use of a Type-5527 iconoscope, with e.s. focusing and deflection. Brief descriptions are given of the vision pre-amplifier, black-level clamp, spurious-signal remover, picture and synchronizing-signal mixer, blanking-pulse amplifier, scanning circuits and power supply.

621.397.62 **874**

Frame Flyback Suppression.—W. T. Cocking. (*Wireless World*, Jan. 1955, Vol. 61, No. 1, pp. 33–35.) An explanation is given of the fact that the flyback trace is commonly visible at the receiver notwithstanding that the form of the television signal is designed to render this part of the trace invisible. Circuits for deriving a suppression pulse from the frame timebase are described; this pulse can be applied, with appropriate polarity, to either grid or cathode of the picture tube.

621.397.62 : 621.397.335 **875**

A Critical Review of Synchronizing Separators with Particular Reference to Correct Interlacing.—G. N. Patchett. (*J. Brit. Instn Radio Engrs*, Dec. 1954, Vol. 14, No. 12, p. 621.) Discussion on 2527 of 1954.

621.397.621.2 : 621.385.832 **876**

Transfer Characteristics and Mu Factor of Picture Tubes.—H. Moss: K. Schlesinger. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, p. 1809.) Comment on 2171 of 1953 and author's reply.

621.397.7 **877**

The Television Centre at Hamburg-Lokstedt.—E. Schwartz. (*Fernmeldetech. Z.*, Sept. 1954, Vol. 7, No. 9, pp. 468–472.) A brief description. For a detailed account see *Tech. Hausmitt. NordwDtsch. Rdfunks*, 1953, Vol. 5, Nos. 7/8.

621.396.712 + 621.397.743 **878**

Plans for F.M.-Radio and Television Networks in Denmark.— G. Pedersen. (*Teleteknik, Copenhagen*, July 1954, Vol. 5, No. 2, pp. 220–230.)

TRANSMISSION

621.396.61 : 621.396.3 **879**

Keying V.L.F. Transmitters at High Speed.—M. I. Jacob & H. N. Brauch. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 148–151.) Naval communication technique is discussed; transmitters with power ranging from 250 kW to 1 MW and operating at frequencies from 15 to 35 kc/s are used. High-speed frequency-shift keying is made possible by varying the resonance frequency of the aerial in synchronization with the signal-frequency variation. This is done by connecting a saturable reactor across the aerial. Successful teleprinter transmissions have been made over distances > 5 000 miles, using an output of 450 kW.

VALVES AND THERMIONICS

621.314.632 : 546.289 **880**

Transient Phenomena in the Backward Direction of Germanium Crystal Rectifiers.—M. Kikuchi & Y. Tarui. (*J. phys. Soc. Japan*, July/Aug. 1954, Vol. 9, No. 4, pp. 642–644.) Theory based on the heating process involved is developed to account for the step variation of the current observed in point-contact rectifiers on sudden application of reverse voltage. The step occurs at the instant when the contact temperature reaches a critical value, estimated to be about 80°C. This result is supported by observations.

621.314.632 : 546.289 : 537.312.6 **881**

An Additional Observation on Thermal Effects in Point Contact Rectifiers.—H. L. Armstrong. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, p. 1345.) Addendum to 1242 of 1954.

621.314.7 **882**

The Effect of a Transverse Electric Field on Carrier Diffusion in the Base Region of a Transistor.—J. S. S. Kerr, J. S. Schaffner & J. J. Suran. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1293–1297.) Analysis is presented for a junction transistor with parallel emitter and collector junctions and a field applied across the base in a direction parallel to the junctions. An expression is obtained for the current gain as the sum of terms each having the same form as that found by Steele (881 of 1953) for the one-dimensional case.

621.314.7 **883**

Expression for the "α Cut-Off" Frequency in Junction Transistors.—D. Haneman. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1808–1809.) The expression $\omega_c = \kappa D_M / W^2$, where D_M is the diffusion constant for minority carriers in the base region of width W, has been used by a number of workers, and various values have been proposed for κ. A method of solution is indicated for nonzero values of W/L_M, where L_M is the diffusion length; in this case κ is a slowly varying function of W/L_M, with a value around 2·5. Results obtained are in qualitative agreement with observations, in particular the prediction that ω_c is more sensitive to variations of collector voltage if ω_c is initially high.

621.314.7 : 621.318.57 **884**

Large-Signal Behavior of Junction Transistors.—J. J. Ebers & J. L. Moll. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1761–1772.) Analysis relevant to the use of transistors for switching is based on recognition of three distinct d.c. operating conditions defined by Anderson (652 of 1953) and corresponding to the on, off, and transition states. Expressions for the impedance in the open and in the closed state are derived in terms of easily measurable transistor parameters. The influence on switching time of the alpha cut-off collector capacitance and minority carrier storage is considered.

621.314.7 : 621.318.57 **885**

Large-Signal Transient Response of Junction Transistors.—J. L. Moll. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1773–1784.) Analysis is based on the three distinct operation states defined previously (884 above). A calculation is made of carrier storage time, or time required for the operating point to move from the collector-current-saturation state to the intermediate state. The alpha cut-off frequency ω_N is the most important parameter affecting switching speed. It is possible with moderate driving current to switch the operating point from collector-current-cut-off to collector-current-saturation in a period of the order of $3/\omega_N$ sec; to permit switching at this speed in the opposite direction, carrier storage effects must be avoided.

621.314.7.002.2 **886**

Manufacturing Grown-Junction Transistors.—F. H. Bower. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 130–134.) A step-by-step account of the procedure.

621.385.029.6 **887**

Some Recent Advances in Microwave Tubes.—J. R. Pierce. (*Proc. Inst. Radio Engrs*, Dec. 1954, Vol. 42, No. 12, pp. 1735–1747.) A review covering high-power klystrons, double-tuned circuits for reflex klystrons, reduction of noise in travelling-wave valves by velocity-jump or space-charge-wave de-amplification, periodic magnetic focusing of the beam, and the backward-wave oscillator. 23 references.

621.385.029.6 **888**

The Wave Picture of Microwave Tubes.—J. R. Pierce. (*Bell Syst. tech. J.*, Nov. 1954, Vol. 33, No. 6, pp. 1343–1372.) The low-level operation of long-beam valves such as klystrons, resistive-wall amplifiers, easitrons, space-charge-wave amplifiers, travelling-wave valves and double-stream amplifiers is discussed in terms of the waves propagated.

621.385.029.6 **889**

Equation for the Oscillations in Uniform Electron Beams.—Yu. A. Katsman. (*Zh. tekh. Fiz.*, July 1954, Vol. 24, No. 7, pp. 1359–1360.) Addendum to 3144 of 1953.

621.385.029.63/.64 **890**

Focusing of a Long Cylindrical Electron Stream by means of Periodic Electrostatic Fields.—Ping King Tien. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1281–1288.) Space-periodic fields produced by a bifilar helix or a series of annular rings are considered. The potential distribution is given in the form of a power series and the equation of electron motion is derived. The solution indicates that the flow is essentially parallel provided the electrons have low transverse velocity on entering the focusing structure and are distributed transversely so that the transverse distribution of space-charge field is similar to that of the focusing field. Numerical examples relevant to the design of travelling-wave valves are presented. The use of a bifilar helix to provide both retardation and focusing is discussed.

621.385.029.63 **891**

Scalloped Beam Amplification.—T. G. Mihran. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, p. 1341.) Brief account of experiments on a valve in which electron bunching is produced by the usual control grid close to the cathode, to which a 1-kMc/s signal is applied, and alternate debunching and bunching occur along the beam under the influence of a longitudinal magnetic field only. R.f. power gain and beam diameter are plotted against beam drift distance. An overall gain of 24 db was measured, of which 10·6 db resulted from the 'scalloped-beam' amplification.

621.385.032.216 : 621.396.822 **892**

On the Flicker Noise Generated in an Interface Layer.—H. J. Hannam & A. van der Ziel. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1336–1340.) The equivalent noise resistance R_n of a valve due to the oxide-cathode interface layer is proportional to the square of the interface resistance R_i and inversely proportional to f^α, where f is the frequency and α ranges from 1·1 for low values of R_i to 1·5 for high values of R_i, at a.f. Experiments are reported proving that the noise originates in the interface layer. Measurements at h.f. indicate an increase in the value of α.

621.385.2 : 621.376.232.2.029.63/.64 **893**

Mechanism of Rectification in Vacuum-Tube Diodes at Microwave Frequencies.—G. Papp. (*Elect. Commun.*, Sept. 1954, Vol. 31, No. 3, pp. 215–219.) The equations of motion of the electrons are derived. Calculation of the diode current indicates that appreciable rectification is obtained; this is confirmed by measurements. Similar work has been reported by Bronwell et al. (3096 of 1954).

621.385.2.032.216 **894**

Effect of Cathode and Anode Resistance on the Retarding-Potential Characteristics of Diodes.—G. C. Dalman. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, pp. 1263–1267.) Anomalous retarding-potential characteristics of diodes with oxide cathodes are explained by taking account of high-resistance layers at cathode and anode; an improvement is thereby obtained in the accuracy of estimating the cathode temperature.

621.385.3 **895**

Amplification Factor and Perveance of an Elliptic Triode.—S. Deb & G. S. Sanyal. (*J. appl. Phys.*, Sept. 1954, Vol. 25, No. 9, pp. 1196–1203.) Expressions for the amplification factor μ, interelectrode capacitance, and perveance P of the triode are derived using a conformal transformation to reduce the elliptic geometry to plane geometry. Results indicate that μ depends on the parametric angle θ of the ellipse and that the average value of μ increases as the grid eccentricity increases and as the anode eccentricity decreases. Curves are presented for finding μ when the value of θ is known. The value of P depends mainly on the grid eccentricity and the focal distance. The theory is illustrated by considering the design of a Type 6C5-GT/G valve.

621.385.3/.5 : 621.317.755 **896**

Development of a Characteristic-Curve Tracer for Transmitting Valves.—Kammerloher & Krebs. (See 816.)

621.385.3.029.63 **897**

The Design of Triodes for U.H.F. Medium-Level Power Amplifiers.—W. E. Rowlands. (*Electronic Engng*, Dec. 1954, Vol. 26, No. 322, pp. 522–527.) Valves with parallel-plane electrode systems are considered, for operation at about 2 kMc/s with output of about 10 W. An expression is derived for radiant-heat dissipation in the grid, and an estimate is made of the influence of the heat-reflection coefficients of the electrodes. Particular attention is devoted to problems arising from cathode evaporation in conjunction with the close spacing of electrodes. A relation between evaporation rate and increase of grid-wire diameter is derived, and the effect of grid growth on valve operation parameters and on valve life is investigated. A life of about 10 000 h appears possible.

621.385.5 : 621.396.822 **898**

Partition Components of Flicker Noise.—T. B. Tomlinson. (*J. Brit. Instn Radio Engrs*, Nov. 1954, Vol. 14, No. 11, pp. 515–526.) In a pentode, the reduction of flicker noise obtained by operating under space-charge-limited conditions (281 of 1953) is to some extent cancelled as a result of the partition of the current between anode and screen grid. Noise measurements made with the valve connected (*a*) normally and (*b*) as a triode confirm the existence of this partition component and provide information on the origin of the flicker noise. Defects giving rise to excessive noise at low frequencies were encountered in standard type valves examined.

621.385.832 **899**

Dark-Trace Display Tube has High Writing Speed.—S. Nozick, N. H. Burton & S. Newman. (*Electronics*, Dec. 1954, Vol. 27, No. 12, pp. 154–156.) A c.r. tube is described in which a high value of beam current for a given spot size, and hence high writing speed, is obtained by using an auxiliary focusing system to reduce the beam diameter in the region of the deflection coils. Writing speeds up to 15 km/s have been attained.

621.387 **900**

A Magnetic Gas-Discharge-Tube Oscillator.—J. M. Somerville. (*J. sci. Instrum.*, Aug. 1954, Vol. 31, No. 8, pp. 279–284.) If a glow discharge is established between an axial cylindrical anode and an outer cylindrical cathode split transversely into two differently biased sections, then, in the presence of a magnetic field, the conductance between the two cathode sections will, under particular operating conditions, be negative. The effects of various factors on the conductance and the efficiency of the tube as an oscillator are discussed. The frequency range is up to about 50 kc/s, and efficiencies up to 70% are attainable. A mercury-vapour split-cathode tube suitable for commercial production is also described.

621.314.7 **901**

Transistoren. [Book Review]—M. J. O. Strutt. Publishers: S. Hirzel Verlag, Zürich and Stuttgart, 1954, 166 pp., DM21. (*Arch. elekt. Übertragung*, Aug. 1954, Vol. 8, No. 8, pp. 371–372.) ". . . the main emphasis of the book is on the technical application of transistors."

MISCELLANEOUS

061.4 : 621.3 **902**

Ninth Annual Electronics Exhibition, Manchester.—(*Instrum. Practice*, Aug. 1954, Vol. 8, No. 8, pp. 703–711.) Illustrated account of the exhibition held in July 1954.

621.38 + 621.39 **903**

Fortschritte der Hochfrequenztechnik, Band 3. [Book Review]—F. Vilbig & J. Zenneck (Eds). Publishers: Akademische Verlagsgesellschaft Geest & Portig K.-G., Leipzig, 1954, 718 pp., DM49. (*Frequenz*, June 1954, Vol. 8, No. 6, p. 198.) Progress reports include surveys on radio-propagation conditions in various wave-bands, the sun and ionosphere, travelling-wave valves, radio-interference suppression, receiver engineering, frequency modulation, etc. A 36-page index is included.

ABSTRACTS and REFERENCES

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ACOUSTICS AND AUDIO FREQUENCIES

534.1-14 : 621.395.61 **904**

Investigation of the Suitability of Ferrites for Application in Underwater Transducers.—H. Thiede. (*Acustica*, 1954, Vol. 4, No. 5, pp. 532–536. In German.) Measured efficiencies and resonance frequencies are tabulated for the relatively few NiZn specimens found under test to be satisfactory for underwater operation. Ferrite materials for acoustic purposes require uniform elastic properties which present-day manufacturing technique does not as yet provide.

534.1-8 : 621.395.61/.62 **905**

Condenser Transmitters and Microphones with Solid Dielectric for Airborne Ultrasonics.—W. Kuhl, G. R. Schodder & F. K. Schröder. (*Acustica*, 1954, Vol. 4, No. 5, pp. 519–532.) Various radiator and microphone systems were tested, but the desirability of choosing a system that could be used as a reversible transducer in reciprocity calibrations limited the choice to one type. This had a backing plate with grooves whose width is equal to that of the intervening rails and is half the depth, and a metallized styroflex foil diaphragm $10\,\mu$ thick. This combination gave a linear relation between transducer current and sound pressure. The microphone frequency response varied only by about 6 db over the range 0·2–100 kc/s. Calibration procedure and errors are discussed. In this connection some measurements were made of the absorption of sound in air at humidities of 0·72% and 1·04% by weight, over the range 20–100 kc/s.

534.232 : 533.7 **906**

Sound Radiation from Vibrating Solids treated by the Kinetic Theory of Gases.—V. Gavreau & A. Calaora. (*C. R. Acad. Sci., Paris*, 15th Nov. 1954, Vol. 239, No. 20, pp. 1272–1274.) The velocity of particles close to the vibrating surface differs from that of the surface itself. Formulae are derived for the intensity of the sound radiated by a piston on the basis of the energy communicated to the gas molecules striking it. Numerical evaluation for the case of air leads to a value of radiated intensity only 87·6% of that obtained assuming the gas to be a continuous fluid. This result has been verified by means of radiation pressure measurements.

534.614-8 : 539.16 **907**

Measurement of Velocity of Ultrasonic Waves in Liquids using Radioactive Indicators.—T. T. Ouang. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, p. 697.) Nodes of standing waves in liquids containing very small quantities of radioactive material are detected by means of a counter or photographic film. Radioactive elements suitable for this purpose are mentioned.

534.85 **908**

Congress on Sound Recording—Paris 1954.—(*Onde élect.*, Oct. 1954, Vol. 34, No. 331, pp. 725–811.) The text is given of a further selection of the papers presented. See also 2560 of 1954 (Houlgate).

621.395.62.089.6 **909**

The Subjective Free-Field Calibration of an External Telephone Receiver by the Equal-Loudness Method.—J. Pritchett. (*Acustica*, 1954, Vol. 4, No. 5, pp. 544–546.)

621.395.623.7 **910**

Some Aspects of the Non-Linear Distortion of Loudspeakers.—C. Bordone. (*Acustica*, 1954, Vol. 4, No. 5, pp. 563–566.) Frequency response and nonlinear distortion measurements on three loudspeakers of 2-, 4- and 6-W power respectively are reported and discussed. The nonlinear distortion, which is least along the loudspeaker axis, can be as large as 15% for certain directions. A comparison of loudspeaker characteristics measured in an anechoic chamber and in a "living room" shows that distortion is nearly always greater in the second case, and that the nonuniformity of the directivity pattern is much more pronounced.

AERIALS AND TRANSMISSION LINES

621.315.2 **911**

The Sarrebourg—Sarreguemines 60-Channel Star Quad Cable.—L. Parcé. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 325–340.) Report on the specifications for and testing of the cable, with descriptions of the test gear used.

621.315.2 **912**

Study of Impedance Uniformity of Spliced Symmetric-Pair Cables.—H. Pech. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 341–350.) A formula is derived relating the cable irregularities measured on factory lengths, and the irregularities not to be exceeded after splicing.

621.315.212 : 621.3.018.78 **913**

Distortion of Cos^2 Pulses in Transmission over a Coaxial Pair.—P. J. M. Clavier. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 351–356.) The response of a cable of length l may be expressed in terms of the response of an arbitrary unit length by changing the time scale by a factor proportional to l^2. This principle is applied to obtain graphs showing distortion for various cable lengths. Expressions for the highest useful test frequency and the corresponding pulse duration are derived in terms of l. Compensation is also discussed.

621.372.029.64 **914**

Radial Line Discontinuities.—J. R. Whinnery & D. C. Stinson. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 46–51.) Curves are presented showing the equivalent shunt capacitance for various types of discontinuity.

621.372.2 + 621.372.87] : 621.317.3.029.6 **915**

The Multiple-Short-Circuit Plunger Technique for the Determination of the Transformation Properties of Lossless $2n$-Terminal Networks between Homogeneous Transmission Lines.—Lueg. (See 1095.)

621.372.5 : 621.396.67.029.55 **916**

The Transport of Energy to the Aerials at S.W. Long-Range Stations.—W. Berndt. (*Telefunken Ztg*, July & Sept. 1954, Vol. 27, Nos. 104 & 105, pp. 104–113 & 163–171.) Requirements at medium- and high-power stations are reviewed, a table showing the range of impedance for balanced and unbalanced feeder lines and aerial types. Design problems and the suitable application of the following devices are discussed in some detail: (*a*) selector switch devices, which include arrangements for connecting ten different transmitters to any ten of 20 aerials, (*b*) switches for reversing the direction of radiation, (*c*) the five most important types of coaxial and wire feeders, (*d*) common-aerial working, (*e*) impedance-transforming devices of the exponential, $\lambda/4$-section, and stub types, (*f*) balun devices.

621.372.8 **917**

The Propagation of Transient Electromagnetic Signals in Waveguides.—A. Rubinowicz. (*Acta phys. polonica*, 1954, Vol. 13, No. 2, pp. 115–133. In German.) The propagation of a monochromatic TE-wave disturbance is considered, commencing at a given instant. If the wavelength is less than the mode cut-off wavelength, a wave is propagated in two parts, the precursor transient and the main signal. The precursor signal travels with the free-space velocity for the medium filling the guide, the main signal with the group velocity. The field intensities for both parts of the signal are obtained in terms of series involving Bessel functions and asymptotic approximation. Energy relations in the wave are considered, and extensions of the results are mentioned.

621.372.8 **918**

A Distributed Electrical Analog for Waveguides of Arbitrary Cross Section.—P. R. Clement & W. C. Johnson. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 89–92.) "The characteristics of uniform waveguides of arbitrary cross section can be studied experimentally by using a two-dimensional transmission line, operating in resonance in its principal mode, as an analog. The model is simple, inexpensive, and quite accurate even for cross sections which have sharp corners. The theory is presented, measurement techniques are discussed, and experimental results are compared with the theoretical values for rectangular and ridged waveguides."

621.372.8 **919**

An Introduction to the Principles of Waveguide Transmission: Part 2—Attenuation, Amplification and Measurement.—C. F. Floyd & W. A. Rawlinson. (*P. O. elect. Engrs' J.*, Oct. 1954, Vo. 47, Part 3, pp. 153–158.) Processes associated with the detection of the waves are described. Part 1 : 18 of January.

621.372.8 **920**

Interpretation of the Effect of an Insulating Film on the Attenuation of the H_0 Wave in a Waveguide with Circular Cross-section.—M. Cotte. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 357–361.) Analysis shows and experiment confirms that a thin dielectric film on the walls may considerably increase attenuation by reducing the reflecting power of the metal and hence, as in the analogous optical case, facilitating transmission into the metal. If a varnish is used, it should be a very thin layer having low permittivity.

621.372.8 **921**

Theory of a Waveguide containing a Spiral, Partly Filled with a Dielectric.—W. P. Schestopalow. (*NachrTech.*, Oct. 1954, Vol. 4, No. 10, pp. 425–430.) German translation of 2884 of 1953.

621.372.8 **922**

Dispersion Characteristic of Sectionalized [disk-loaded] **Waveguide.**—N. M. Sovetov. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1907–1909.) A comparison is made between calculated and experimentally determined phase-velocity dispersion characteristics of circular waveguides with disks of radius $b = 58{\cdot}5$ mm, disk-aperture-radius $a = 15$ mm, and disk-spacing $d = 10$ mm, at wavelengths near 14·5 cm. Calculated curves are also given for waveguides with $b/a = 2$, 3, or 5, and $(b-a)$ in the range $1{\cdot}2$–$5{\cdot}2\lambda$.

621.372.8 **923**

Excitation of Non-ideal Radio Waveguides.—V. A. Il'in. (*C. R. Acad. Sci. U.R.S.S.*, 21st Oct. 1954, Vol. 98, No. 6, pp. 925–928.) Solutions are obtained by the method developed by Samarski & Tikhonov (*Zh. tekh. Fiz.*, Nov. 1947, Vol. 17, No. 11, pp. 1283–1296 and 3335 of 1948) and used by Il'in (17 of January). The zero-order approximation, i.e. the solution of the ideal case, can be used within the 'radius of action' which, in the case of a Cu waveguide operating at 10 cm λ, is about 10 m. The presence of angularities has a negligible effect on the character of energy losses in the waveguide.

621.372.8 **924**

Coupling of Two Waveguides of Similar Cross-Sections.—B. Z. Katsenelenbaum. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1892–1906.) A theoretical treatment.

621.372.8 : 538.221 **925**

Electromagnetic Waves in Rectangular Waveguide filled with Magnetized Ferrite.—A. L. Mikaelyan. (*C. R. Acad. Sci. U.R.S.S.*, 21st Oct. 1954, Vol. 98, No. 6, pp. 941–944.) Solutions are obtained for the equations of wave propagation for transverse magnetization of the ferrite.

621.372.8 : 621.376.3 **926**

Harmonic Distortion in Waveguides with Sinusoidal Frequency Modulation.—L. Robin. (*C. R. Acad. Sci., Paris,* 15th Nov. 1954, Vol. 239, No. 20, pp. 1279–1280.) A formula involving Bessel functions is derived for the harmonic distortion with f.m. for a guide with perfectly conducting walls and arbitrary cross-section. Notation and theory developed previously (1282 of 1953) are adapted. Numerical calculation for a round guide of radius 3·825 cm and length 3 km, using a carrier frequency of 35 kMc/s, a modulation frequency of 7·5 Mc/s and a modulation index of 1·5, indicates that the harmonic distortion is low.

621.372.8 : 621.384.622.2 **927**

Experimental Study of Waveguide with [internal] **Helix for Linear Accelerator for Heavy Particles: Phase Velocity.**—A. Septier. (*C. R. Acad. Sci., Paris,* 22nd Nov. 1954, Vol. 239, No. 21, pp. 1367–1369.) Measurements of guide wavelength were made on a section of the guide terminated by reflectors at both ends, so as to become a resonator. The arrangements studied were (*a*) bare helix, (*b*) shielded helix, (*c*) helix held by three radial plexiglass supports, (*d*) use of three supports occupying greater volume. Curves of phase velocity as a function of frequency show the retarding effect of these arrangements.

621.372.8 : 621.384.622.2 **928**

Experimental Study of Waveguide with [internal] **Helix for Linear Proton Accelerator: Shunt Impedance.**—A. Septier. (*C. R. Acad. Sci., Paris,* 29th Nov. 1954, Vol. 239, No. 22, pp. 1476–1478.) An investigation is made of the influence of the insulating helix supports on the *Q* value and shunt impedance of the guide. The results are compared with theoretical predictions.

621.396.67 **929**

An Application of Sommerfeld's Complex-Order Wave Functions to Antenna Theory.—C. H. Papas. (*J. Math. Phys.,* Oct., 1954, Vol. 33, No. 3, pp. 269–275.) Analysis is presented for an aerial comprising a coaxial line whose inner conductor is terminated by a hemispherical boss while the outer conductor is provided with an infinite flange. An accurate expression is derived for the admittance, involving functions which have not yet been tabulated.

621.396.67 **930**

Scattering of Electromagnetic Waves by Wires and Plates.—J. Weber. (*Proc. Inst. Radio Engrs,* Jan. 1955, Vol. 43, No. 1, pp. 82–89.) A theoretical treatment with particular reference to the wave polarization changes produced. An approximate solution is obtained for scattering from a rectangular plate. The centre-driven wire and the wire as a receiving aerial are treated. A method based on the scattering properties is indicated for measuring the input impedance of the centre-driven wire. Expressions obtained for the scattered field and back-scattering cross-section of the wire with sinusoidal current distribution are reasonably accurate for aerial lengths up to nearly a wavelength.

621.396.67 **931**

Current Distribution along a Cylindrical Radiator.—P. Poincelot. (*C. R. Acad. Sci., Paris,* 22nd Nov. 1954, Vol. 239, No. 21, pp. 1365–1367.) An error in the analysis presented previously (2119 of 1952) is corrected; a solution is derived in the form of an infinite system of linear algebraic equations.

621.396.67 **932**

Distribution of Current along a Cylindrical Transmitting Aerial.—P. Poincelot. (*C. R. Acad. Sci., Paris,* 29th Nov. 1954, Vol. 239, No. 22, pp. 1472–1474.) Continuation of analysis presented previously (931 above). Convergent expressions are obtained for the coefficients of the Fourier series representing the distribution.

621.396.67.029.45 **933**

Considerations in the Design of Aerials for Radiotelegraphy Transmissions in the Very-Low-Frequency Range.—P. Bouvier. (*Ann. Radioélect.,* Oct. 1954, Vol. 9, No. 38, pp. 342–351.) Description of the design and construction of the aerial system at Jim Creek, Washington [821 of 1953 (Hobart)] stressing the factors justifying the project and making comparison with earlier high-power l.f. aerial systems.

621.396.673 **934**

The Folded Ground Plane.—J. C. Belcher. (*Short Wave Mag.,* Oct. 1954, Vol. 12, No. 8, pp.432–434. Correction, *ibid.,* Dec. 1954, Vol. 12, No. 10, p. 560.) A brief discussion of the earthed vertical folded aerial. The advantages include high input impedance, large bandwidth, low height (λ/4) and simple mechanical construction.

621.396.674.1.029.51 **935**

Ferromagnetic Loop Aerials.—J. S. Belrose. (*Wireless Engr,* Feb. 1955, Vol. 32, No. 2, pp. 41–46.) Design of aerials for the frequency range 80–200 kc/s is discussed from the point of view of obtaining the best possible signal/noise ratio. Results are reported of experiments with loop aerials using ferroxcube rod or tube cores. For a receiver bandwidth of 100 c/s a sensitivity of 1 μV/m with a signal/noise ratio of 10 db is shown to be possible.

621.396.677 **936**

Plane Aerials with Small Side Lobes.—G. F. Koch. (*Fernmeldetech. Z.,* Oct. 1954, Vol. 7, No. 10, pp. 498–509.) 'Angle attenuation' rather than magnitude of side lobes is chosen as the criterion for assessing polar diagrams of aerials for radio links. Simple diffraction theory indicates that rhombic apertures and those bounded by exponential, cosine, cosine-squared and cosine-cubed curves have better directivity than the usual square or circular apertures. Nonuniform as well as uniform aperture illumination is considered. Experimental results support the theory.

621.396.677 **937**

Newly Developed Directive Aerials for Decimetre and Centimetre Wavelengths.—K. O. Schmidt. (*Fernmeldetech. Z.,* Oct. 1954, Vol. 7, No. 10, pp. 495–497.) A short survey; general formulae applicable to any form of directive aerial are presented.

621.396.677 **938**

Wide-Band Directive Aerials for Wavelengths below 20 cm.—W. Stöhr. (*Fernmeldetech. Z.,* Oct. 1954, Vol. 7, No. 10, pp. 510–515.) The performances of various types of parabolic-reflector and lens aerials in the 2-, 4- and 6-kMc/s bands are compared, the most important data being tabulated. The preferred arrangement is a parabolic-sector reflector with large horn primary radiator; the direction of illumination is perpendicular or nearly perpendicular to the paraboloid axis, and the side of the horn comes right up to meet the edge of the reflector. The long horn is advantageous from the point of view of matching.

621.396.677.3 **939**

Design of Linear Arrays giving Optimum Radiation Pattern.—S. Herscovici. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 352–359.) Duhamel's procedure (2225 of 1953) is reviewed and a simple matrix method is described for evaluating the excitation coefficients; this is particularly advantageous when the number of elements is large. See also 331 of 1954 (Stegen).

621.396.677.3.029.6 **940**

Beaming Electric Waves by Director Plates.—G. von Trentini. (*Z. angew. Phys.*, Oct. 1954, Vol. 6, No. 10, pp. 462–470.) Aerial systems with high gain (up to about 17·5 db) for the 3–10-kMc/s frequency range are considered theoretically and several experimental arrangements are described. The beaming of the waves from a dipole or waveguide radiator is obtained by a series of parallel plates normal to the direction of propagation and parallel to the electric vector, spaced at about $\lambda/2$. Both diffraction and reflection effects take place. The method can also be applied at lower frequencies, where perforated plates or wire mesh can be used in preference to the more strongly frequency-dependent Yagi director aerial systems.

621.396.677.45.029.63 **941**

High-Gain Side-Firing Helical Antennas.—H. G. Smith. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, May 1954, Vol. 73, pp. 135–138. Digest, *Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, p. 896.) A helical side-firing aerial for the 500–1 000-Mc/s range comprises a coil on a coaxial conducting cylindrical mast. Within a range of power gain (G) from 5 to 10, relative to a dipole, the required helix-mast spacing (S) is given by $S = \lambda/G$ for a helical conductor diameter of $\lambda/100$, turn length 2λ, and pitch $\lambda/2$. A coaxial stack of five such bays, excited in phase, produces a power gain of about 25 and a main-beam half-power width of 2°.

AUTOMATIC COMPUTERS

681.142 **942**

Relay Time-Division Multiplier.—G. A. Korn & T. M. Korn. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, pp. 977–982.) A simple valve-less multiplier for use in analogue computers is described.

681.142 **943**

Three-Dimensional Analogue Computer.—(*Engineer, Lond.*, 15th Oct. 1954, Vol. 198, No. 5151, pp. 532–533.) The Tridac is an electronic-hydraulic machine developed for the Royal Aircraft Establishment for solving problems in radar and guided-missile operation. It occupies 6 000 ft^2 of floor space, uses 8 000 valves and consumes 650 kW under peak conditions. Individual mathematical operations are performed with an error $\not> 0{\cdot}1\%$ of full scale. The basic analogue quantity is a d.c. voltage and the basic element is a d.c. amplifier with a gain of the order of 60 000, stabilized by association with an a.c. amplifier.

681.142 : 512.831 **944**

The Calculation of the Latent Roots and Vectors of Matrices on the Pilot Model of the A.C.E.—J. H. Wilkinson. (*Proc. Camb. phil. Soc.*, Oct. 1954, Vol. 50, Part 4, pp. 536–566.)

681.142 : 621.37 **945**

Resistance-Network Analogues with Unequal Meshes or Subdivided Meshes.—G. Liebmann. (*Brit. J. appl. Phys.*, Oct. 1954, Vol. 5, No. 10, pp. 362–366.) "A general method for deriving the finite difference approximations to the partial differential equation div K grad $U = g$, which is solved by resistance-network analogues, is applied to find the resistance values and the currents which have to be fed in for (x, y)- and (r, z)-networks with unequal mesh sizes. Two ways of subdividing a network into finer meshes in the ratio 1 : 2 are then given, and a network subdivision in the ratio 2 : 5 is described. Experimental tests have shown that these subdivisions introduce negligible errors into the measured field distributions."

681.142 : 621.373.1 **946**

A Phonic-Wheel Generator for Position Indication in Digital-Computer Magnetic-Drum Storage.—D. R. Quested & A. D. Booth. (*J. sci. Instrum.*, Oct. 1954, Vol. 31, No. 10, pp. 357–360.) The design is discussed of a variable-reluctance phonic-wheel generator for frequencies above 20 kc/s. The final form comprises a rotating slotted disk and polarizing permanent magnet placed centrally between two pickup heads. Pickup output as high as 5 mV/turn has been attained. The system has been adopted in the A.P.E.(X.)C.-type computer [1184 of 1951 (Booth)].

681.142 : 621.395.625.3 **947**

Calculation of the Magnetic Field in the Ferromagnetic Layer of a Magnetic Drum.—O. Karlqvist. (*Kungl. tek. Högsk. Handl., Stockholm*, 1954, No. 86, 28 pp.) The variation of the field with permeability, air gap, layer thickness and other factors is investigated, assuming the ferromagnetic layer to be of low-permeability spinel material. While the problem is nonlinear, the linear approximation is satisfactory in some cases. Numerical computations are presented for the drum used in the Swedish computer 'Besk'.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.016.35 **948**

Extension of the Generalized-Phase-Diagram Method for studying the Stability of Linear Systems.—P. Lefèvre. (*Rev. gén. Élect.*, Oct. 1954, Vol. 63, No. 10, pp. 619–640.) Extension of work reported previously [3127 of 1949 (Demontvignier & Lefèvre)]. A rule for interpreting the phase diagram leading to a simpler method of application is described. The damping necessary to ensure stability is investigated by a graphical method; an analytical method is developed using a characteristic algebraic equation with real coefficients.

621.3.049.7 **949**

Automatic Production for Electronics.—W. H. Hannahs. (*Elect. Mfg*, July 1954, Vol. 54, No. 1, pp. 116–124.) A review of the techniques and design factors.

621.3.066.6 **950**

The Influence of Electrical Current on the Contact between Metals.—F. P. Bowden & J. B. P. Williamson. (*Research, Lond.*, Oct. 1954, Vol. 7, No. 10, pp. S53–S55.) Experiments are reported in which two blocks of gold were pressed together in such a way as to localize contact in a single region, and current pulses were passed whose duration was chosen in relation to the time constants of the contact so as to produce the effect of a continuous current. The constriction resistance between the blocks was measured before and after passage of a pulse; from these values the changes in the contact area were calculated. The results indicate that below a critical value of current the contact area is unchanged, but above this current value the contact area is increased by passage of current.

621.314.22 **951**

A Versatile Output Transformer for Surge Generators.—J. D. Harmer & J. R. Howells. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp.

22–23.) Description of a tapped toroidal transformer designed to match the generator to a wide range of values of load impedance without altering the form of the surge.

621.316.726.078.3 : 621.317.7.029.64 **952**

Microwave Discriminator: Part 1—Stabilization of [oscillator for] **Test Bench.**—R. Fanguin & G. Raoult. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, pp. 133A–138A.) A discriminator for stabilizing a reflex klystron operating at 10 kMc/s is discussed. A small portion of the klystron output is applied to a cavity resonator, and the sum and difference of the resonator response and the incident signal are used, after detection and amplification, to provide the control voltage for the klystron reflector electrode.

621.316.727 : 621.373.4 **953**

Closed-Loop Automatic Phase Control.—P. F. Ordung, J. E. Gibson & B. J. Shinn. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954, Vol. 73, pp. 375–381. Digest, *Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, p. 915.) The method described of designing a phase control system for an oscillator is based on an application of techniques of servomechanism analysis.

621.318.4 **954**

Wafer-Coil Development for Inductive Components.—A. Zack & T. Wroblewski. (*Sylvania Technologist*, Oct. 1954, Vol. 7, No. 4, pp. 99–102.) The automatic production of coils made of insulated metal foil, instead of wire, is described. The roll of foil is sliced into thin wafers which can be connected in series to obtain the required inductance. Physical and electrical characteristics are similar to those of wire-wound coils. Closer spacing of turns is possible than with printed-circuit techniques.

621.318.435.3 **955**

Transductors with Four-Limbed Cores.—A. G. Milnes. (*Proc. Instn elect. Engrs*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 554–558.) "Transductors with four-limbed cores have characteristics which differ from those of conventional transductors in their symmetry with respect to control-current changes. Such transductors are suitable for increasing the sensitivity of non-polarized relays and may be operated by either d.c. or a.c. signals. The suppression of response to negative signals is also possible with four-limbed transductors, and this may be used to reduce swamping effects in push-pull magnetic amplifiers subjected to large signal inputs."

621.318.57 **956**

Accurate Linear Bidirectional Diode Gates.—J. Millman & T. H. Puckett. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 29–37.) Discussion of switching circuits to be controlled by a.f. square-wave voltages, with gates of several milliseconds. Bridge arrangements of two, four and six diodes are described. Operating factors considered include amplitude of control voltage, gain, constancy of gain/signal characteristic, backward leakage through the diodes, and effects of unbalance. Series, parallel and series-parallel combinations are illustrated; the use of a series-parallel arrangement of gates for processing radar data is described.

621.319.4 : 537.224 **957**

The Capacity and Field of a Split Cylindrical Condenser when the Conductors Differ in Length.—H. J. Peake & N. Davy. (*Brit. J. appl. Phys.*, Oct. 1954, Vol. 5, No. 10, pp. 371–373.) The transformation $z = b.\mathrm{dn}\,(Kw/U,)$ using the usual notation of Jacobian elliptic functions, gives the complex potential at any point in the z plane, for the case of a plate of width $2bk'$, raised to a potential U, symmetrically placed between two semi-infinite plates at zero potential at distance $2b$ apart. From this, the field and the capacitance $K'/K\pi$ of the system are obtained by the method of inversion. By comparing the results with those of a previous paper (655 of March), two algebraic identities for the elliptic integrals K and K' are obtained.

621.319.4 : 537.311.33 **958**

The Charging and Discharging of Nonlinear Capacitors.—J. R. Macdonald & M. K. Brachman. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 71–78.) Capacitors with semiconductor, photoconductor or electrolytic dielectrics involving space charge polarization [1024 of 1954 (Macdonald)] are discussed and a formula is derived for the C/V characteristic. The charging and discharging processes in such a capacitor are compared with those for a capacitor in which C is an increasing exponential function of V. The time variation of the differential capacitance of the space-charge type during charging and discharging is investigated and is compared with the behaviour of a linear capacitor exhibiting a distribution of relaxation times.

621.372 **959**

The Relation between Time- and Frequency-Functions with Practical Examples of the Calculation of the Transient Response of Linear Transmission Systems.—V. Fetzer. (*Arch. elekt. Übertragung*, April 1954, Vol. 8, No. 4, pp. 163–172.)

621.372 **960**

The Practical Calculation of Transient Response for Arbitrary Attenuation and Phase Distortion.—V. Fetzer. (*Arch. elekt. Übertragung*, Oct. 1954, Vol. 8, No. 10, pp. 467–477.) Phase characteristic is determined from a given attenuation/frequency curve by Bode's method. The locus of the complex transfer coefficient is approximated by Fourier series. The calculated coefficients are used to evaluate the response function (see 959 above) for the case of (*a*) unit-pulse and (*b*) unit-step input. As an example the transfer functions are determined for three different i.f. amplifier characteristics in a p.p.m. receiver. The accuracy of the method in giving the general shape of the transient response curve is verified using Samulon's method (1856 of 1951). An appendix contains formulae for calculating the Fourier coefficients required and tables of the functions $\sin x/x$ and $\int_0^x \sin u\, du/u$ applying in cases (*a*) and (*b*) respectively.

621.372.4 **961**

Equivalence of Two-Terminal Networks.—K. H. R. Weber & I. Schlegel. (*NachrTech.*, Oct. 1954, Vol. 4, No. 10, pp. 430–433.) Simple procedure is indicated for synthesizing or recognizing equivalent two-terminal networks containing three or more circuit elements.

621.372.5 **962**

Comment on "Networks Terminated in Resistance at Both Input and Output".—L. Weinberg. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, p. 98.) Theory presented previously for *RLC* lattice networks (3535 of 1953 and 1332 of 1954) is supplemented by indicating a method for obtaining *R* or *RC* terminations. See also *Convention Record Inst. Radio Engrs*, 1954, Part 2, pp. 90–95.

621.372.5 **963**

Displacement of the Zeros of the Impedance $Z(p)$ due to Incremental Variations in the Network Elements.—A. Papoulis. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 79–82.) A method is presented for evaluating errors introduced in the analysis of *LC* networks by assuming that the elements are purely reactive.

621.372.5 **964**

Response Characteristics of a Linear System with Third-Order Transfer Function.—S. Barabaschi & E. Gatti. (*Alta Frequenza*, Oct. 1954, Vol. 23, No. 5, pp. 211–231.) The rise time and delay time of a low-pass system on application of a step-function input are calculated using Elmore's formulae (653 of 1949). Conditions for minimizing these times are determined for functions with three poles and two zeros. The pulse transformer is treated as a numerical example; the calculations are supported by experimental results, as long as consideration is restricted to no-overshoot conditions.

621.372.5 : 621.396 **965**

Radio-Frequency Phase-Difference Networks: a New Approach to Polyphase Selectivity.—G. B. Madella. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 102–103.) Comment on 1910 of 1954 (Cifuentes & Villard).

621.372.512.24 **966**

Forced Oscillations in Nonlinear Systems with Two Degrees of Freedom.—D. Graffi. (*R. C. Accad. naz. Lincei*, Feb. 1954, Vol. 16, No. 2, pp. 176–180.) Analysis is given leading to the establishment of criteria for the stability of oscillations in *LCR* circuits coupled by mutual inductance.

621.372.54 **967**

Image Parameters of Filters with One or Two Cut-Off Frequencies and Notes on the Decomposition of the Transfer Coefficient.—J. E. Colin. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 277–288.) A table is given of formulae for the image transfer coefficients and image impedances of high-pass, band-pass and band-stop filters. Methods of expressing the transfer coefficients as the sum of the transfer coefficients of the basic sections are explained, though the band-stop case cannot be included. The filters are considered to be without loss and without mutual inductance.

621.372.54 **968**

Narrow-Band Filter composed of *RC* Quadripoles.—H. Wittke & K. Stambke. (*Funk u. Ton*, Oct. 1954, Vol. 8, No. 10, pp. 530–536.) The design of filter circuits for very low frequencies is discussed. Oscillograms illustrate the suppression of noise superposed on a 5-c/s signal. For theory of *RC* quadripoles, see also 1627 of 1953 (Krastel).

621.372.54 **969**

Transient Operation of Low-Pass and High-Pass Lattice Filters.—M. L. D'Atri. (*Alta Frequenza*, Oct. 1954, Vol. 23, No. 5, pp. 232–254.) An expression is derived for the admittance of the lattice filter terminated by its characteristic impedance functions. Using a new inverse transformation method, the unit-step response of some low-pass filters and the unit-function response of some high-pass filters are determined. A simple method is indicated for determining the response to an arbitrary voltage.

621.372.54 : 621.372.8 **970**

Direct-coupled Waveguide Filters.—H. Scheftelowitz. (*Ericsson Tech.*, 1954, Vol. 10, No. 2, pp. 253–296.) Filters are considered of the type comprising chains of cavity resonators with a common iris separating adjacent cavities. Design methods based respectively on (*a*) impedance considerations, (*b*) wave matrices, and (*c*) equivalence between the waveguide filter and the lumped-element filter are described for determining the susceptance of the irises and their separation. Theory is given for the case of mismatching, and formulae are derived for parallel and cascade couplings. A four-channel branching system for frequencies ranging from 4·76 to 4·96 kMc/s is described.

621.372.56.029.6 : 621.318.134 **971**

Ferrite Attenuators in Helixes.—J. A. Rich & S. E. Webber. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 100–101.) Directional attenuation has been observed using a Ni-Zn-ferrite cylinder fitting closely round a helix. Attenuation/frequency curves are shown for two values of axial magnetic field, and attenuation/magnetic-field curves are shown for frequencies of 1·8, 2·4 and 3 kMc/s. The directional effect is considerably higher than indicated by elementary theory; the reason for the discrepancy is discussed.

621.372.8 : 621.318.134 : 538.614 **972**

Ferrite Phase Shifters in Rectangular Wave Guide.—B. Lax, K. J. Button & L. M. Roth. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1413–1421.) Propagation theory is developed for a nonreciprocal device with asymmetrical arrangement, as described by Kales et al. (2040 of 1954), losses in the ferrite being neglected. The dependence of the phase shift on the thickness of the ferrite slab, on the degree of asymmetry, and on the intensity of the transverse magnetic field is investigated. The field configuration in the guide is shown diagrammatically for some special cases. A modification with two symmetrically arranged ferrite slabs and antiparallel magnetic fields is also discussed.

621.373.421.13 **973**

Design of 'Aperiodic' Oscillator Circuit with Inductive Quartz Crystal.—H. Awender & K. Sann. (*Funk u. Ton*, Oct. 1954, Vol. 8, No. 10, pp. 520–529.) The discussion is illustrated by a numerical example of an oscillator using a Type-EF80 valve and suitable in the 50–800-kc/s or 0·8–20-Mc/s band. See also 2892 of 1954.

621.373.52 : 621.311.6 **974**

A New Self-Excited Square-Wave Transistor Power Oscillator.—G. C. Uchrin & W. O. Taylor. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, p. 99.) The basic circuit uses a push-pull arrangement of power transistors in conjunction with a transformer consisting of a centre-tapped primary, centre-tapped feedback, and output winding, and a single d.c. source. An explanation of the operation and oscillograms of waveforms obtained are presented. Good efficiency is obtained over a frequency range 15 c/s–8 kc/s; the range has been extended up to 20 kc/s with reduced efficiency. Application to l.v./h.v. conversion of d.c. power is discussed.

621.375.2 + 621.373.42 **975**

Class-C Amplifier and Oscillator Design.—L. T. Apps. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 30–32.) Charts are presented for simplifying the design procedure, using a method based on that of Terman & Roake (*Proc. Inst. Radio Engrs*, 1936, Vol. 24, p. 620.)

621.375.2 **976**

Mixing Preamplifier.—F. J. Davis & P. W. Reinhardt. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, p. 1024.) A circuit for mixing signals from several photocells has diodes connected in the grid circuit of the separate input valves so as to avoid signal attenuation which would otherwise result from the parallel arrangement of these valves.

621.375.2 : 621.385.029.6 **977**

Traveling-Wave Tube System having Multiplied Gain.—F. R. Arams. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, p. 102.) Advantage is taken of the wide frequency band of travelling-wave valves to obtain increased gain by heterodyning the output to a different frequency and then feeding it to the valve again. The system is useful in microwave relay stations where it is in any case necessary to change the carrier frequency to prevent feedback from the transmitting aerial to the receiving aerial.

621.375.2.029.3 **978**

Gramophone and Microphone Pre-amplifier.—P. J. Baxandall. (*Wireless World*, Jan. & Feb. 1955, Vol. 61, Nos. 1 & 2, pp. 8–14 & 91–94.) The equipment is designed primarily for use with the 10-W amplifier described previously (1328 of 1948). Separate input stages and gain controls for gramophone and microphone channels are followed by a mixing circuit. The full output of 4 V r.m.s. can be obtained with harmonic distortion $\not> 0{\cdot}1\%$ for sinusoidal inputs ranging from 1 mV to about 50 mV with microphone, and from 20 mV to 1 V with gramophone.

621.375.2.029.4 **979**

The Use of Double Triodes in High-Gain Low-Frequency Amplifiers.—R. G. Wylie. (*J. sci. Instrum.*, Oct. 1954, Vol. 31, No. 10, pp. 382–383.) "The type of amplifier stage employing a double triode is described in which one triode section provides a high dynamic load resistance for the plate circuit of the other . . . An amplifier utilizing three such stages and possessing a gain of the order of 10^6 is described."

621.375.2.029.4 : 535.23.08-1 **980**

Infrared-Spectrophotometer Amplifier.—M. N. Markov. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1867–1875.) An amplifier for use with a low-impedance bolometer is described with complete circuit diagram. The amplifier input is of the order of 2×10^{-9} V at a frequency of 9 c/s, corresponding to a power input of 6×10^{-9} W; the overall amplification is $\sim 3{\cdot}5 \times 10^9$. The methods used to reduce noise, valve microphony, etc., are discussed.

621.375.226 **981**

On the Integral Width of Cascaded Tuned Amplifiers.—K. M. van Vliet, J. Blok & C. Ris. (*Physica*, Oct. 1954, Vol. 20, No. 10, pp. 762–766.) "A formula is derived by which the overall integral bandwidth B of an amplifier containing a number of noninductively coupled LC circuits is expressed in the effective quality factors Q_i of the separate resonance circuits. The quantity B can also be expressed in the integral widths B_i of the separate circuits; for two or three stages very simple relations are found."

621.375.227 **982**

A New Circuit for balancing the Characteristics of Pairs of Valves.—R. E. Aitchison. (*Nature, Lond.*, 9th Oct. 1954, Vol. 174, No. 4432, p. 704.) Both static and dynamic characteristics of a pair of valves are balanced by adjusting the heater voltages by means of a potentiometer of a few ohms resistance in series with the heater supply circuit.

621.375.3 **983**

Derivative Controlled Magnetic Amplifiers.—A. D. Schnitzler. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 1021.) Summary of paper published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954. A two-stage circuit for a low-level fast-response unit is described. The first stage acts as derivative amplifier, amplifying average increments of signal voltage per half cycle of power supply voltage. The second stage acts as integrator, amplifying and summing the output voltage of the first stage. If the negative feedback applied to the first stage is delayed, e.g. by a low-pass filter, the total time constant of a system incorporating the amplifier can be effectively reduced.

621.375.3 **984**

Magnetic Amplifiers with Inductive D.C. Load.—H. F. Storm. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 1007.) Summary of paper published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954. The instability region in the control characteristic curve is discussed, and a method of avoiding operation in this region suggested.

621.375.3 : 621.316.7 **985**

Characteristics of Magnetic Amplifiers for Industrial Use.—R. G. Beadle & B. P. Chausse. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, pp. 1023–1027.) A specification for standard units suitable for regulator applications is drawn up. The relative importance of the advantages and disadvantages of magnetic amplifiers is considered in detail for (*a*) pre-amplifiers, (*b*) limited-range regulators, (*c*) motor field current regulators, (*d*) Ward-Leonard drives. H.f. amplifiers have a faster response than other types but at extra expense and with added complication.

621.375.3.024 **986**

Pulse Relaxation Amplifier: a Low-Level D.C. Magnetic Amplifier.—R. E. Morgan & J. B. McFerran. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954, Vol. 73, pp. 245–249; *Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, pp. 909–913.) The principles of operation are explained. Linear amplification can be obtained for an input signal of 10^{-11} W in a 4-stage amplifier delivering an output of 10^{-5} W. Variation of the temperature between -70°C and $+140$°C and of the supply voltage by $\pm 30\%$ resulted in a maximum zero drift of less than 10^{-16} W over a two-week period. The gain varied by 10% for a 10% change of the supply frequency.

621.375.4 : 621.314.63 **987**

Diode Amplifier.—(*Tech. News Bull. nat. Bur. Stand.*, Oct. 1954, Vol. 38, No. 10, pp. 145–148.) Outline of the properties and applications of amplifiers based on the reverse transient phenomenon associated with the high degree of carrier storage in Ge and Si junction diodes. The frequency of the power supply must not be less than that of the modulating signal. Such amplifiers can be used as pulse repeaters, in flip-flop circuits, or as wide-band flat-response amplifiers. Faster operation can be obtained with Si than with Ge diodes.

GENERAL PHYSICS

53.081.4 **988**

A New System of Logarithmic Units.—R. V. L. Hartley. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 97–98.) A general discussion of the subject treated by Green (81 of January).

534.2 + 538.566 **989**

Correlation of Amplitude and Phase Fluctuations in Wave Propagation in a Statistically Inhomogeneous Medium.—L. A. Chernov. (*C. R. Acad. Sci. U.R.S.S.*, 21st Oct. 1954, Vol. 98, No. 6, pp. 953–956. In Russian.) The cases considered are (*a*) the correlation of fluctuations of amplitude and phase at a single receiving point and (*b*) the correlation of amplitude or phase fluctuations at different receiving points. In the case of large-sized inhomogeneities the correlation between the amplitude or phase fluctuations extends over a range of the same order as the correlation between the random inhomogeneities of the medium itself.

537.2 **990**

Surface Distributions of Fixed Charges and Poynting Vector in a System of Permanent Volume Currents.—É. Durand. (*C. R. Acad. Sci., Paris*, 15th Nov. 1954, Vol. 239, No. 20, pp. 1276–1278.) Theoretical study of conditions in a hollow cylindrical conductor.

537.226 : 537.529 **991**

Present State of Theory of Electric Breakdown in Solid Dielectrics.—V. A. Chuenkov. (*Uspekhi fiz. Nauk*, Oct. 1954, Vol. 54, No. 2, pp. 185–230.) A survey. The theory of the first stage of dielectric breakdown, the loss of electric strength, can probably be given best in terms of a kinetic equation for electrons in a solid. The effective cross-sections of ionization for low-energy electrons, the probability of scattering of medium-energy electrons by the vibrating lattice and the effective cross-section of recombination must be determined. The theory of the second stage, the actual breakdown, has not, as yet, been given. It is suggested that the cause of the breakdown could be connected with processes leading to the production of a shock wave analogous to that occurring in the breakdown of gases at high pressures. 66 references include over 30 to Russian literature.

537.525 **992**

Mechanism of H.F. Discharge between Plane Plates.—F. Schneider. (*Z. angew. Phys.*, Oct. 1954, Vol. 6, No. 10, pp. 456–462.) The problem is considered using the Schottky diffusion theory of the positive column with a term added to take account of the h.f. character of the discharge. Measurements show that the electron temperature is higher than in a d.c. discharge under similar conditions. A theory is proposed which explains the dependence of the running potential on frequency.

537.525 : 538.69 **993**

Effect of Secondary Electrons on Initiation of H.F. Discharges.—F. Kossel & K. Krebs. (*Z. Phys.*, 16th Oct. 1954, Vol. 139, No. 2, pp. 189–196.) Initiation of discharges between parallel electrodes in inert gases was investigated at pressures of 10^{-5}–1 Torr using a frequency of $1{\cdot}27 \times 10^{9}$ c/s and magnetic fields up to 900 G. Two effects due to a transverse magnetic field were observed: (*a*) decrease of breakdown potential, and (*b*) suppression of a glow discharge. The former is due to the 'cyclotron effect'; the maximum reduction of 54% occurred at a field strength $H = 2\pi fm/e$ where f is the frequency of the electric field. The latter is shown to be due to prevention of the secondary-electron resonance effect observed in a longitudinal magnetic field and noted by Farnsworth in his work on the secondary-electron multiplier.

537.525 : 621.318.57.029.6 **994**

Effect of Moving Striations on Microwave Conductivity of a Coaxial Discharge.—H. L. Steele, Jr, & P. J. Walsh. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1435–1436.) Experiments were made with a discharge tube arranged so that part of the discharge path fills a gap along the inner conductor of a coaxial line. The results indicate a marked variation of the microwave conductivity as striations move past the gap. The effect may be strong enough to use for switching purposes.

537.533 : 537.534.8 **995**

Electron Emission from Metals under High-Energy Hydrogen Ion Bombardment.—B. Aarset, R. W. Cloud & J. G. Trump. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1365–1368.)

537.533.1 : [621.385.029.6 + 621.384.622.2 **996**

Method of Measurement of the Velocity of High-Energy Electrons.—M. Papoular. (*C. R. Acad. Sci., Paris*, 8th Nov. 1954, Vol. 239, No. 19, pp. 1194–1196.) Formulae relating the beam voltage to the oscillation frequency in carcinotrons and loaded-waveguide linear accelerators are used to determine the electron velocity; the only apparatus required is a wavemeter together with a small line. Velocities approaching that of light are treated; relativity effects are taken into account.

537.533.8 **997**

The Similarity Law of Secondary Emission.—J. L. H. Jonker. (*Philips Res. Rep.*, Oct. 1954, Vol. 9, No. 5, pp. 391–402.) Measurements were made of the secondary-emission yield factor for a number of materials under carefully controlled conditions, particularly with respect to clean target surface. Results then agreed well with the experimentally obtained universal curve (2197 of 1952), a formula for which is also given.

537.533.8 **998**

Determination of the Proportion of Reflected Electrons in the Secondary-Electron Emission from Copper and Gold.—F. Speer. (*Z. Phys.*, 16th Oct. 1954, Vol. 139, No. 2, pp. 226–238.) An experimental determination is reported. The retarding-field method of Gobrecht & Speer (3581 of 1953) was used, with primary potentials of 200–3 000 V, and the secondary-electron yield was corrected for the space-charge effect. At a primary potential of 1 000 V and a retarding potential of 40 V, the percentages of reflected electrons in the total secondary-electron yield are 35 ± 5% and 38 ± 4% for Au and Cu, respectively; at 3 000 V the percentages are 47 ± 6% and 43 ± 5% respectively. The results are presented graphically and are tabulated.

537.56 : 538.6 **999**

Galvomagnetic and Thermomagnetic Effects in a Plasma.—A. A. Ware. (*Proc. phys. Soc.*, 1st Oct. 1954, Vol. 67, No. 418A, pp. 869–880.)

537.582 **1000**

Experimental Determination of the Energy Distribution of Thermoelectron Beams.—H. Boersch. (*Z. Phys.*, 16th Oct. 1954, Vol. 139, No. 2, pp. 115–146.) An investigation using the Lenard retarding-field method is reported. This method gave results accurate to within 0·004 eV for electron energies in the range 20–60 keV. Results indicate that a Maxwell distribution occurs only at low beam currents and densities. No direct dependence was found on cathode temperature, space charge at the cathode or control potential; a dependence was observed on current density and to a lesser degree on current intensity. Deviations from Maxwell's distribution could not be attributed to errors in calculation, collisions with the residual gas, spectrometer effect of the emitter, transverse resistances of cathode, or local anomalies of the work function;

positive results were obtained by relating the electron energy distribution to longitudinal space-charge oscillations produced by the shot effect. Shifts of the energy distribution are due to changes in the work function and the development of a potential barrier near the cathode.

538.221 **1001**

Deduction of Magnetic Interaction in *s-d*-Exchange Model of Ferromagnetic Metal.—E. A. Turov. (*C. R. Acad. Sci. U.R.S.S.*, 21st Oct. 1954, Vol. 98, No. 6, pp. 945–948.)

538.221 : 538.652 **1002**

Quantum Theory of Magnetostriction of Ferromagnetic Single Crystals.—A. A. Gusev. (*C. R. Acad. Sci. U.R.S.S.*, 11th Oct. 1954, Vol. 98, No. 5, pp. 749–752. In Russian.) Theory is developed for crystals with hexagonal or cubic symmetry at low temperatures. Results indicate that magnetostriction is connected with the magnetic interaction of electrons, and also give the temperature dependence of magnetostriction constants in the case investigated.

538.313 **1003**

The Perfectly Conducting Ring subjected to High-Frequency Currents and Magnetic Fields.—H. Buchholz. (*Arch. elekt. Übertragung*, Oct. 1954, Vol. 8, No. 10, pp. 427–435.) Detailed analysis of the interaction of current and field for a ring of circular cross-section, (*a*) with current flowing in a conductor along its axis, (*b*) carrying a h.f. current induced by a field in the ring aperture and (*c*) in an alternating field due to a coaxial current ring. Explicit formulae are derived for the complex impedance of the ring in cases (*a*) and (*b*). Functions are tabulated for calculating energy losses in case (*c*).

538.56 : 530.145 **1004**

A Derivation of Maxwell's Equations for a Vacuum by means of an Energy-Quantum Model.—H. Zuhrt. (*Arch. elekt. Übertragung*, Oct. 1954, Vol. 8, No. 10, pp. 447–456.) Propagation phenomena such as interference and diffraction can be explained by means of quantum theory if the energy quanta are assumed to have finite volume. The magnitude of this volume is estimated from consideration of the energy received by a dipole in a 300-Mc/s field of strength 100 μV/m.

538.566 **1005**

Theory of the Trentini Absorption Grid.—W. Franz. (*Z. angew. Phys.*, Oct. 1954, Vol. 6, No. 10, pp. 449–456.) Exact theory is developed for absorption of a normally incident e.m. wave by a loaded grid placed near and parallel to a conducting surface. The case when a dielectric intermediate layer is present is also considered. See also 204 of 1950, and 3483 of 1953 (von Trentini).

538.566 : 535.43 **1006**

Scattering from Dielectric-Coated Spheres in the Region of the First Resonance.—H. Scharfman. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1352–1356.) Calculations based on methods developed previously [e.g. 1259 of 1952 (Aden & Kerker)] indicate that a dielectric-coated conducting sphere can be made to have a greater scattering cross-section than an uncoated conducting sphere of the same overall diameter. This was confirmed experimentally using technique described by Scharfman & King (2310 of 1954). Results of calculations and measurements are shown graphically. A physical interpretation is presented.

538.566 : 537.533 : 621.372.8 **1007**

Electromagnetic Wave Propagation in Bounded Electron Beams.—P. Parzen. (*Quart. appl. Math.*, Oct. 1954, Vol. 12, No. 3, pp. 309–312.) Maxwell's equations in appropriate form are solved subject to boundary conditions chosen in accordance with a particular uniqueness theorem, which is proved. Modes of propagation in a waveguide completely filled with an electron beam are determined.

538.569.4 **1008**

A Simple High-Temperature Microwave Spectrograph.—P. A. Tate & M. W. P. Strandberg. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, pp. 956–958.) Equipment for operation in the frequency range 600°–1 000°C is described, based on the Stark modulation effect.

539.23 : 535.393 **1009**

Determination of Thickness and Optical Constants of 'Thin' Films.—C. v. Fragstein. (*Z. Phys.*, 16th Oct. 1954, Vol. 139, No. 2, pp. 163–174.) Theory is given relating the thickness and optical constants of very thin ($<$ 70Å) metallic films deposited on glass to the reflected and transmitted light intensities. Wolter's theory (*Z. Phys.*, 1937, Vol. 105, Nos. 5/6, pp. 269–308) is discussed.

53.08 **1010**

The Physics of Experimental Method. [Book Review]—H. J. J. Braddick. Publishers: Chapman & Hall, London, 1954, 404 pp., 35s. (*Nature, Lond.*, 16th Oct. 1954, Vol. 174, No. 4433, pp. 712–713.) The statistical interpretation and mathematical manipulation of experimental results and the natural limits of measurement are treated. Electrical measurements, electronic devices and vacuum techniques are among subjects selected for discussion; examples of appropriate instrument technology are included.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **1011**

Radio Astronomy.—J. A. Roberts. (*Research, Lond.*, Oct. 1954, Vol. 7, No. 10, pp. 388–399.) A survey of techniques and results.

523.16 **1012**

The Remnants of Supernovae as Radio Sources in the Galaxy.—R. H. Brown. (*Observatory*, Oct. 1954, Vol. 74, No. 882, pp. 185–194.) A critical survey is presented of recent work on the sources of galactic radio emission at metre wavelengths. Observations indicate that remnants of supernovae may account for some of the sources and radio emission may be due to collisions of gas at high velocities. Results of flux density calculations at 100 Mc/s are tabulated.

523.16 **1013**

Novae and Radio Noise.—G. Larsson-Leander. (*Observatory*, Oct. 1954, Vol. 74, No. 882, pp. 219–220.) Calculations show that r.f. radiation generated when two nova shells are merging should be observable in the early stages.

523.16 : 523.72 **1014**

An Analysis of Bursts of Solar Radio Emission and their Association with Solar and Terrestrial Phenomena.—R. D. Davies. (*Mon. Not. R. astr. Soc.*, 1954, Vol. 114, No. 1, pp. 74–92.) "Solar radio emission records on seven frequencies in the range 60 to 10 000 Mc/s were studied over a period of 18 months. The analysis, which includes a number of histograms, shows that many of the properties of bursts change with frequency. A study of the time delay between bursts on different frequencies revealed that 3 000 Mc/s bursts often occur first; a simultaneous up and down movement of ionized material from the level of zero refractive index at that frequency is postulated. It is found that bursts were more frequent than flares, fadeouts and crochets and that they almost always accompanied these effects. The commencement of bursts appears to be simultaneous with that of flares and crochets but precedes that of fadeouts by about two minutes. In addition, there is a rough correlation between the intensity of bursts, flares, fadeouts and crochets."

523.16 : 537.562 : 538.561 **1015**

Charge Segregation occurring with Streaming in Ionized Gases, and Cosmic R.F. Radiation.—R. W. Larenz. (*Naturwissenschaften*, Oct. 1954, Vol. 41, No. 20, pp. 470–471.) A discussion of the extent to which space-charge fluctuations can occur in a plasma which is neutral as a whole. Formulae are derived for the ion and electron concentrations as functions of time and space for the quasi-stationary one-dimensional case. It is suggested that r.f. radiation is related to the oscillations executed with comparable amplitude by both ionic and electronic components of the plasma.

523.5 : 061.3 **1016**

A Symposium on Meteor Physics at Jodrell Bank.—T. R. Kaiser. (*Observatory*, Oct. 1954, Vol. 74, No. 882, pp. 195–208.) Report of the symposium held in July 1954, at which 38 papers were presented. These include several on radio-echo investigations, ionization and excitation, and one paper on a possible mechanism of production of galactic radiation.

523.5 : 621.396.96 **1017**

Theory of the Meteor Height Distribution obtained from Radio-Echo Observations: Part 1—Shower Meteors. Part 2—Sporadic Meteors.—T. R. Kaiser. (*Mon. Not. R. astr. Soc.*, 1954, Vol. 114, No. 1, pp. 39–62.)

523.74/.75 **1018**

Distribution of Coronal Flares as a Function of Latitude during the Course of the Solar Cycle.—M. Trellis. (*C. R. Acad. Sci., Paris*, 3rd Nov. 1954, Vol. 239, No. 18, pp. 1119–1121.) Distributions consistent with the commencement of the new sunspot cycle have been observed.

523.746 **1019**

Notes on the Sunspot Cycle.—C. N. Anderson. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 455–461.) Analysis of a long series of sunspot cycles based on a 169-year period and illustrating the negligible gravitational effect of the planets.

550.3 : 517.512.2 **1020**

Practical Methods of Harmonic Analysis for Geophysical Problems.—R. P. Kane. (*Proc. Indian Acad. Sci. A*, March 1954, Vol. 39, No. 3, pp. 117–126.) Use of Fourier series for resolving the diurnal variations of geophysical elements is discussed. Rapid methods of analysis based on 12-ordinate and 24-ordinate schemes are described.

550.384 : 523.78 **1021**

Magnetic Observations at Quetta during the Total Solar Eclipse of June 30.—S. A. A. Kazmi. (*Nature, Lond.*, 9th Oct. 1954, Vol. 174, No. 4432, p. 706.)

550.385 **1022**

An Intuitive Description of the Chapman-Ferraro Theory of the Initial Phase of a Magnetic Storm.—T. Nagata. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 467–470.) The main mathematical results of the theory are derived from a simple consideration of the dynamic characteristics of a stream of ionized particles in a magnetic field.

550.385 **1023**

Transients of Magnetographs and Instantaneous Values from Recordings.—S. L. Malurkar. (*Proc. nat. Inst. Sci. India*, Sept./Oct. 1954, Vol. 20, No. 5, pp. 567–569.)

551.510.41 **1024**

Relation between Atmospheric Ozone and Storms.—A. Vassy. (*C. R. Acad. Sci., Paris*, 15th Nov. 1954, Vol. 239, No. 20, pp. 1309–1311.) Comparison of records indicates that the ozone concentration increases during storm times; the increase occurs suddenly, on the average 3½ hours before the first discharge.

551.510.5 **1025**

Measurement of Atmospheric Humidity up to 35 Kilometers.—C. J. Brasefield. (*J. Met.*, Oct. 1954, Vol. 11, No. 5, pp. 412–416.)

551.510.5 : 523.5 : 621.396.96 **1026**

Scale Heights and Pressures in the Upper Atmosphere from Radio-Echo Observations of Meteors.—S. Evans. (*Mon. Not. R. astr. Soc.*, 1954, Vol. 114, No. 1, pp. 63–73.) Methods are described for determining pressure and scale height in the altitude range 88–100 km, making use of theory developed by Kaiser (1017 above).

551.510.52 : 535.325 **1027**

Notes on the Atmospheric Refractive Index in Canada from Aircraft Meteorological Soundings.—A. S. G. Grant. (*Trans. Amer. geophys. Union*, June 1954, Vol. 35, No. 3, pp. 508–510.) Values of the r.f. refractive index calculated from soundings made in connection with a shoran survey are compared with standard values.

551.510.534 **1028**

The Latitudinal and Seasonal Variations of the Absorption of Solar Radiation by Ozone.—J. Pressman. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 485–498.) Calculations indicate that the length of day and the solar altitude factor are sufficient to give the major features of the ozone solar absorption.

551.510.535 **1029**

Short-Period Variations in the Ionosphere.—Y. Nakata. (*J. Radio Res. Labs Japan*, March 1954, Vol. 1, No. 2, pp. 1–82.) A comprehensive review is presented of methods and results of ionospheric research. Short-period fluctuations are discussed in relation to theories of layer formation.

551.510.535 **1030**

Procedures used to improve the Quality of Ionospheric Data.—S. C. Gladden. (*Trans. Amer. geophys. Union*, June 1954, Vol. 35, No. 3, pp. 398–404.) Data from 21 field stations are regularly dealt with by the Ionospheric Data Quality Control Group of the Upper Atmosphere Research Section at the C.R.P.L. An outline is given of the procedures used, with special reference to the detection of errors.

551.510.535 **1031**

Statistical Analysis of "150-km" Echo.—D. D. Chaffee, Jr. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 549–550.) Further investigation of the 150-kc/s echo from above the normal night-time E layer [724 of 1954 (Lindquist)]. An analysis of *h't* data for the period

January 1951 to July 1953 indicates definite peaks in the percentage duration of these echoes at the equinoxes and a positive 27-day recurrence tendency. No definite correlation has been found with sunspot numbers, magnetic-storm data or E_s.

551.510.535 **1032**

Electron Densities in the Ionosphere.—J. C. Seddon. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 463–466.) A fresh interpretation of data obtained from rocket measurements (403 of 1954), based on a breakdown in the independence of propagation of the magneto-ionic components of a c.w. signal transmitted from the rocket, gives an electron density curve in agreement with $P'f$ records.

551.510.535 **1033**

Continuous Electron Density Measurements up to 200 km.—J. C. Seddon, A. D. Pickar & J. E. Jackson. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 513–524.) Electron distribution at altitudes from 84 to 200 km was determined accurately from measurements made during a rocket flight at 1000 h MST on May 7th 1954 (f_0F_2 4·8 Mc/s). Using $P'f$ records, the electron density curve was extrapolated to the F_2 maximum ($2{\cdot}9 \times 10^5$ electrons/cm^3 at 288 km). Density increased rapidly between 91 and 101 km. In the 170–200-km region densities were in general 5–10% lower than the F_1 maximum ($2{\cdot}1 \times 10^5$ at 170 km). Slight gradient variations in the lower ionosphere are probably the major cause of large variations of F_2-layer virtual height. Sporadic echoes are apparently due to partial reflections from high-gradient regions.

551.510.535 **1034**

Spread F over Washington.—G. Reber. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 445–448.) Analysis of records for the period 1944–1953. Diurnal curves for seasons and years throughout this period are similar, with spread F occurring more frequently in winter than in summer and equinox values usually midway between those for summer and winter solstices. Sample data from six other stations show different characteristics; phenomena at Watheroo merit further study. See also 3213 of 1954.

551.510.535 **1035**

Atomic Nitrogen as a Constituent for Region F_1.—A. P. Mitra. (*Indian J. Phys.*, June 1954, Vol. 28, No. 6, pp. 269–284.) Three temperature/height models are considered, (*a*) the Nicolet-Mange model, (*b*) the possible upper limit of temperature/height gradient, and (*c*) an intermediate model. For these, particle concentration with height, the rate coefficient of reaction with height and the height and concentration of maximum ionization are critically discussed and computed. The level of maximum ionization produced by photoionization of atomic nitrogen lies between 150 and 200 km, depending on the model considered. The concentration of atomic nitrogen at the height at which diffusive separation takes place need not be assumed to be greater than $\frac{1}{10}\,n\,(N_2)$. Hence atomic nitrogen could contribute at least in part to the F_1-layer ionization. The possibility of ionization of atomic oxygen at the third ionization potential is briefly discussed.

551.510.535 **1036**

A Consideration of the Electron Disappearance in the F_2 Layer of the Ionosphere.—T. Yonezawa. (*J. Radio Res. Labs Japan*, March 1954, Vol. 1, Nos. 3 & 4, pp. 1–62 & 4–111.) Factors influencing the electron concentration, and conventional theories of recombination and attachment are reviewed. Nocturnal diffusion can account for only a small variation of concentration, but its effect on the altitude of maximum concentration is not necessarily negligible. Statistical analysis indicates that the influence of pressure on the nocturnal variation of electron concentration is unexpectedly small, while that of temperature is large. Analysis of the monthly mean values indicates that attachment rather than recombination is the mechanism responsible for the electron disappearance. The influence of layer movements, though not large, is significant. Further evidence in favour of the attachment theory is obtained from consideration of f_0F_2 distribution and from a comparison of the nocturnal concentration variations at two sites. Theoretical considerations favour a process of electron removal in which collisions between atomic ions of oxygen and excited molecules of nitrogen produce molecular ions of nitrogen which in turn recombine with electrons.

551.510.535 **1037**

A Theoretical Investigation of the Ionospheric Electron Density Variation during a Solar Eclipse.—O. E. H. Rydbeck & H. Wilhelmsson. (*Chalmers tek. Högsk. Handl.*, 1954, No. 149, 22 pp.) The investigation reported previously by Rydbeck (3783 of 1945) is extended to the general case of $D \geqslant d$, where D is the apparent diameter of the moon and d that of the sun; a uniform distribution of radiation over the solar disk is assumed. Convenient formulae are derived for the minimum electron density and for the time of occurrence of the minimum. For a partial eclipse of magnitude M, an approximate expression is derived giving minimum electron density as a function of M with an error not greater than the experimental error of the average ionospheric sounding equipment.

551.510.535 : 551.594.21 **1038**

Thunderstorms and Sporadic-E Ionization of the Ionosphere.—S. K. Mitra & M. R. Kundu. (*Nature, Lond.*, 23rd Oct. 1954, Vol. 174, No. 4434, pp. 798–799.) A study was made of the increase of E_s ionization during severe squall-type storms which are a feature of the weather in Bengal in the pre-monsoon months March–May. The transmitter frequency was gradually increased as the squall approached, and the frequency fE_s at which the E_s echo disappeared was noted. The observations were repeated every four minutes. Results are shown graphically for two typical cases. Values of fE_s as high as 10 Mc/s were observed, compared with the average no-storm value of 3·5–5 Mc/s.

551.510.535(98) : 621.396.11 **1039**

Geographic and Temporal Distribution of Polar Blackouts.—V. Agy. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 499–512.) "Tabulations of hourly values of the ionospheric parameters for 18 northern-hemisphere stations have been used to derive diurnal variations in the occurrence of 'blackout' [no-echo] conditions. Contour plots are presented showing the diurnal average percentage of time during which blackout conditions prevailed, the amplitude of the diurnal variation, and the time of maximum frequency of occurrence. Changes in the contours with season and with magnetic activity are discussed."

551.510.535 "1954" : 621.396.11 **1040**

Ionosphere Review, 1954.—T. W. Bennington. (*Wireless World*, Feb. 1955, Vol. 61, No. 2, pp. 66–68.) Evidence indicates that the sunspot minimum had occurred before the end of 1954. The latest sunspot cycle exhibited the asymmetry characteristic of cycles with high maximum; the increasing phase lasted 39 months and the decreasing phase about 83 months. Smoothed sunspot-number and critical-frequency curves show close correlation. The increase of m.u.f. at sunspot maximum is greatest for winter day and least for winter night. Frequencies over 30 Mc/s appear to have been usable for long-distance communication during four winters around the sunspot maximum.

551.594.2 **1041**

Upward Stepped Leaders from the Empire State Building.—B. F. J. Schonland & D. J. Malan. (*J. Franklin Inst.*, Oct. 1954, Vol. 258, No. 4, pp. 271–275.) A new interpretation is presented of the observations reported by McEachron (971 of 1942).

551.594.21 **1042**

Observations on the Negatively-Charged Column in Thunderclouds.—C. A. Hacking. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 449–453.)

551.594.5 : 621.396.11.029.55 **1043**

Doppler-Shifted Radio Echoes from Aurora.—K. L. Bowles. (*J. geophys. Res.*, Dec. 1954, Vol. 59, No. 4, pp. 553–555.) Note on the results of an experiment in which alternate pulsed and c.w. signals at 25·4 Mc/s were transmitted northward from a 100-W transmitter. Signals recorded at a receiver 15 miles away with aerial beamed north showed a Doppler frequency shift upward or downward correlating respectively with homogeneous and rayed auroral forms. When a homogeneous arc breaks into a rayed structure both shifts may be recorded simultaneously.

551.594.6 : 621.396.11.029.45 **1044**

Very-Low-Frequency Noise Power from the Lightning Discharge.—J. S. Barlow, G. W. Frey, Jr, & J. B. Newman. (*J. Franklin Inst.*, Sept. 1954, Vol. 258, No. 3, pp. 187–203.) Present knowledge about the lightning-discharge mechanism is reviewed; particular attention is paid to the theory of Bruce & Golde (966 of 1942). Computed power spectra of (*a*) a nearby cloud-to-ground flash and (*b*) a distant daytime atmospheric are compared, taking propagation effects into account [232 of 1954 (Bowe)]. The results confirm the presence of a peak at about 10 kc/s in the spectra of the distant atmospherics. 46 references.

LOCATION AND AIDS TO NAVIGATION

621.396.932 **1045**

Problems of Direction-Finding on Ships at Frequencies in the Intermediate Band (1·5–3·5 Mc/s).—A. Troost. (*Telefunken Ztg*, Sept. 1954, Vol. 27, No. 105, pp. 149–155.) Resonant structures aboard ship are sources of considerable error at these frequencies. The effects are considered in some detail. Mounting a small crossed-loop aerial as high as possible on the ship reduces errors considerably, but errors can be suppressed if the sources are located by measurements while the ship is in harbour.

621.396.933.1 **1046**

Radio Compass for Airlines.—(*Elect. J.*, 1st Oct. 1954, Vol. 153, No. 14, p. 1043.) Description of the automatic direction finder Type AD7092C, which includes tunable sense amplifiers to overcome intermodulation problems encountered in areas with numbers of broadcasting stations close together. Bearing accuracy is within ± 2°. The weight of the equipment is 15·3 lb.

621.396.96 **1047**

Radar Experiments in the Port of Hamburg.—W. A. Krause. (*Telefunken Ztg*, Sept. 1954, Vol. 27, No. 105, pp. 132–138.) Experiments were carried out using Type-31 3-cm Decca equipment to determine the required number and location of transmitters to provide a radar map of the port approaches on a 1 : 10 000 scale, and of the port itself on 1 : 5 000. One main and two subsidiary unattended stations should suffice in each case.

621.396.96 : 551.578.1 **1048**

C-Band Weather Radar.—(*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 20–21.) An investigation made at McGill University [2951 of 1954 (Hitschfeld & Marshall)] led to the choice of the C band (5·5 cm), in preference to the X and S bands, for aircraft weather-radar equipment. Tests have been made by United Air Lines of an equipment designed to penetrate 60-mm/h rainfall to a depth of 15 miles; satisfactory results were obtained. P.p.i. presentations corresponding to various phases of storms are reproduced.

621.396.96 : 621.396.6.002.2 **1049**

New Techniques for Fabrication of Airborne Electronic Equipment.—R. K. F. Scal. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 4–11.) Developments of miniaturization techniques at the National Bureau of Standards have been reported previously [307 of 1951 (Henry et al.)]. An account is now given of the development of radar equipment, to have a life of 2 000 h and to operate at altitudes > 50 000 ft and at temperatures between − 65° and + 55°C. The various units are easily removable, and include a mixer-duplexer incorporating a plug-in waveguide flange and socket. The internal connections are made by a three-dimensional arrangement of processed (e.g. printed) plates. A closed air-cooling system is provided. The total weight is 55 lb. Some tests on the equipment are reported.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **1050**

The Electronic Clean-Up of Gases in Sealed-Off Vacuum Systems.—R. N. Bloomer & M. E. Haine. (*Vacuum*, April 1953, Vol. 3, No. 2, pp. 128–135.) An experimental investigation is reported. Typical log-pressure/time clean-up curves show two linear portions; in portion A the pumping speed is a few cm^3/sec and is proportional to the ionizing electron current, in portion B pumping speed is independent of current above a few tens of microamperes, but the speed is only about a twentieth as great. The cleaned-up gas is held by the glass walls, particularly in the vicinity of the electrode structure.

533.5 : 531.788 **1051**

The Experimental Determination of the Speed of a Vacuum Pump and of Components of a Vacuum System.—C. W. Oatley. (*Brit. J. appl. Phys.*, Oct. 1954, Vol. 5, No. 10, pp. 358–362.) For pressure equilibrium in a vessel, the rate a at which air leaks in is equal to the speed b of the pump in series with the exhaust aperture. Keeping a constant and measuring the pressure at various fixed exhaust aperture sizes, b can be simply determined by a graphical method. An ionization gauge was used in the experiment. The interchangeable aperture device is described.

533.58 **1052**

Production of Very High Vacua with the Aid of Getters.—S. Wagener. (*Z. angew. Phys.*, Oct. 1954, Vol. 6, No. 10, pp. 433–442.) A summary is presented of experimental results in the production of vacua down to pressures of the order of 10^{-9} mm Hg. See also 3566 of 1954 and back reference.

537.224 : 621.396.822 **1053**

Electrical Noise Pulses from Polarized Dielectrics.—N. P. Baumann & G. G. Wiseman. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1391–1394.) Measurements on carnauba-wax and polyvinyl-acetate electrets are reported; the noise-pulse rate was observed as the electrets were heated. The noise appears to be associated with the decay of volume polarization rather than with real surface charge. The total charge associated with the noise pulses from the carnauba-wax type is at least 5% of the maximum electret charge.

537.226.2 : 539.13 **1054**

Influence of Molecular Shape on the Dielectric Constant of Polar Liquids.—F. Buckley & A. A. Maryott. (*J. Res. nat. Bur. Stand.*, Oct. 1954, Vol. 53, No. 4, pp. 229–244.)

537.227 : [546.431.824-31 + 546.42.824-31 **1055**

Ferroelectric Properties of Solid Solutions in the System Barium-Titanate/Strontium-Titanate.—G. A. Smolenski & K. I. Rozgachev. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1751–1760.) Results are reported of an experimental investigation on specimens containing up to 95% molar of $SrTiO_3$. The dielectric-constant/temperature characteristics of the specimens, determined at 1 kc/s and at 740 kc/s, exhibit a maximum whose value increases from about 7 500 for pure $BaTiO_3$ up to about 15 000 for a 60% $SrTiO_3$ solution, decreasing again at higher concentrations of $SrTiO_3$. The temperatures at which these maxima occur decrease from about 120°C for pure $BaTiO_3$ to about − 200°C for 90% $SrTiO_3$. Spontaneous polarization is a minimum in 30–40% $SrTiO_3$ solutions. Phase transitions, the effect of applying a constant electric field, and spontaneous electrostriction were also investigated. Results are presented graphically.

537.227 : 546.431.824-31 : 621.315.612.4 **1056**

Dielectric Bodies in Metal-Stannate Barium-Titanate Binary Systems.—W. W. Coffeen. (*J. Amer. ceram. Soc.*, 1st Oct. 1954, Vol. 37, No. 10, pp. 480–489.) Ceramic and dielectric properties of bodies composed of $BaTiO_3$ plus the stannates of Mg, Pb, Bi, Zn, Ni, Cu, Cd, Co, Mn, and Fe, and of bodies in the system tin-oxide-$BaTiO_3$, have been investigated. Results of measurements on 80 specimens are tabulated and presented graphically.

537.311.31 : 548.0 : 546.3-1 **1057**

Electronic Structure of Primary Solid Solutions in Metals.—J. Friedel. (*Advances Phys.*, Oct. 1954, Vol. 3, No. 12, pp. 446–507.) A study of the structure of alloys in which an impurity element is present in quantities so small that its atoms are dispersed in the matrix of the main element and only weak interaction occurs. The main problem examined is the effect on the conduction electrons of a metal when a localized charge is introduced in an interstitial or substitutional position. Two different approximations corresponding respectively to the molecular and atomic orbitals are derived; the former is more useful for studying fast electrons and properties related to Fermi level while the latter may be better for computing energies of dissolution.

537.311.33 **1058**

New Semiconductors.—R. W. Douglas & C. H. L. Goodman. (*G.E.C. J.*, Oct. 1954, Vol. 21, No. 4, pp. 215–220.) The qualities required of materials for use in crystal valves are discussed. Materials with covalent-ionic type of bonding are capable of providing both the high charge-carrier mobility and the relatively high energy-gap value required. 'Substitute diamond' type structures are the simplest having such bonding; ternary compounds of chalcopyrite structure and quaternary compounds of stannite structure are described.

537.311.33 **1059**

A General Asymptotic Solution of Reaction Equations Common in Solid-State Chemistry.—G. Brouwer. (*Philips Res. Rep.*, Oct. 1954, Vol. 9, No. 5, pp. 366–376.) Simple approximate solutions are given of equations derived by Kröger et al. (*Z. phys. Chem.*, 1954, Vol. 203, p. 1) for the incorporation of vacancies into a semiconductor.

537.311.33 **1060**

Electronic Equilibrium of Illuminated Semiconductors.—G. Wlérick. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, pp. 667–676.) The effect of illumination is explained by introducing two quasi-Fermi levels, for the free electrons and holes respectively; the forbidden band is effectively narrowed by an amount equal to the difference between these levels. Three modes of action of the illumination are considered: (*a*) ionization of impurity centres; (*b*) production of band-to-band transitions; (*c*) combination of (*a*) and (*b*). Various possible transition processes from temperature-controlled to illumination-controlled equilibrium are discussed. For specimens containing a large number of impurity centres only feebly ionized when not illuminated, the photoconductive properties may be the same for both (*a*) and (*b*) types of action.

537.311.33 **1061**

Method of determining the Parameters of a Semiconductor.—F. G. Bass & I. M. Tsidil'kovski. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1834–1836.) A method is discussed for determining the carrier mobility u and the parameter n, defined by the equation $l = l_0(T)\, v^n$ where l is the mean free path of the carrier and is a function of temperature T, and v is the carrier velocity. Formulae are given for the Hall effect, the longitudinal and transverse Nernst-Ettinghausen effects and two new longitudinal-transverse galvanomagnetic and thermomagnetic effects, in terms of functions of n and of $(u\,H/c)$, where H is the applied magnetic field and c is the velocity of light. The new effects occur when the direction of a magnetic field applied in the XZ plane makes an angle $\theta = \pi/2$ with the current flowing along the X axis; the electric field produced is in the direction of the Z axis and is independent of the sign of H. An experimental check, which is not described, gave values of u and n obtained from measurements of the Hall effect and of the new effects in agreement with previously published results.

537.311.33 **1062**

The Photomagnetoelectric Effect in Semiconductors under Sinusoidal Conditions. Application to the Measurement of Minority-Carrier Lifetime.—J. Grosvalet. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 360–365.) Considering a thick specimen illuminated by a sinusoidally modulated light source, the expression $\tan 2\phi = \omega\tau$ is derived relating the minority-carrier lifetime τ to the phase angle ϕ between the two voltages due to photoconductive and photomagnetoelectric effects. Using a measurement method based on that described by Aigrain (139 of January) with modulation frequencies of 0·1, 0·3, 1·5 and 3 kc/s, this expression is applied to determine τ in the range 1 ms–10 μs. Correction curves are given for measurements on samples $<$ 5 mm thick.

537.311.33 **1063**

Theory of Internal Field Emission in Cubic Crystals.—J. Homilius & W. Franz. (*Z. Naturf.*, March 1954, Vol. 9a, No. 3, pp. 205–210.) Conditions for field-emission breakdown in face-centred and in body-centred crystals are derived, using theory related to that of McAfee et al. (164 of 1952). The directional variation of breakdown field strength is at least 20%. The formulae are used to examine the particular conditions for PbS, PbTe, Si and Ge.

537.311.33 : 536.21 **1064**

Correlation of Thermal Conductivity of Semiconductors with Electron Mobility.—A. V. Ioffe & A. F. Ioffe. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1910–1911.) Comment on 2968 of 1954 (Goldsmid). A table is given of corrected calculated values of thermal conductivities of C, Si, Ge, PbS, and Te, and of the mean free paths of phonons and electrons, together with experimental results.

537.311.33 : 536.21 **1065**

Effect of Admixtures on Thermal Conductivity of Semiconductors.—A. V. Ioffe & A. F. Ioffe. (*C. R. Acad. Sci. U.R.S.S.*, 11th Oct. 1954, Vol. 98, No. 5, pp. 757–759. In Russian.) The expression for thermal conductivity derived by means of the kinetic theory is modified to take account of the greater number of collisions and the shorter mean free path of phonons when admixtures are present in the lattice. Calculations of the thermal conductivity in the case of various amounts of PbSe admixture in PbTe, Sb in Ge, and Si in Ge, give results in good agreement with experiment.

537.311.33 : 538.66 **1066**

Change of Thermal Conductivity of Semiconductors in Magnetic Field.—Kh. I. Amirkhanov, A. Z. Daibov & V. P. Zhuze. (*C. R. Acad. Sci. U.R.S.S.*, 1st Oct. 1954, Vol. 98, No. 4, pp. 557–560. In Russian.) The transverse Righi-Leduc effect was investigated experimentally. No change of thermal conductivity was observed in Te, MoS_2, Bi_2Te_3 and PbTe in transverse magnetic fields up to 11 000 oersted, indicating that the Righi-Leduc effect amounted to less than 0·2%; the thermal resistivity of Bi and HgSe increased with field strength. The results agree with theory.

537.311.33 : 546.28 **1067**

On the Production of Pure Silicon.—K. Ono & T. Matsushima. (*Sci. Rep. Res. Inst. Tohoku Univ., Ser. A*, Oct. 1954, Vol. 6, No. 5, pp. 477–496.) Investigations on the production of pure Si by the reduction of $SiCl_4$ with Zn are described.

537.311.33 : 546.28 **1068**

Diffusion of Boron and Phosphorus into Silicon.—C. S. Fuller & J. A. Ditzenberger. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1439–1440.) Methods of producing large-area *p-n* junctions by diffusing B or P into Si are briefly described.

537.311.33 : [546.289 + 546.681 **1069**

Germanium and Gallium and their Applications.—A. R. Powell. (*Nature, Lond.*, 2nd Oct. 1954, Vol. 174, No. 4431, pp. 627–629.) Report of papers presented at the British Association meeting in September 1954, describing the occurrence of Ge and Ga in British minerals and their extraction from flue dust, problems in the analysis of the raw materials and finished products, and scientific and industrial applications of Ge.

537.311.33 : 546.289 **1070**

The Transistor: Part 3—Material Aspects: the Production of Transistor Grade Germanium.—E. A. Speight & J. I. Carasso. (*P. O. elect. Engrs' J.*, Oct. 1954, Vol. 47, Part 3, pp. 166–169.) Part 2: 296 of January (Roberts). An error in part 2 is noted.

537.311.33: 546.3-1.46.86 : 539.23 **1071**

Investigation of Films of Variable Composition in the System Mg-Sb.—I. V. Mochan. (*C. R. Acad. Sci. U.R.S.S.*, 1st Oct. 1954, Vol. 98, No. 4, pp. 579–582. In Russian.) An experimental investigation is reported of the dependence of electrical conductivity of Mg-Sb films on the Sb content. The conductivity drops sharply by a factor of several powers of ten at a concentration of Sb which varies from about 97% Sb in vacuo to about 80% Sb after six days exposure to air. The photoeffect cut-off at about 0·8μ indicates that the changes are probably due to an increase of the Mg_3Sb_2 component in the film after exposure to air, and not to oxidation.

537.311.33 : [546.48.241.1 + 546.682.241.1 **1072**

Experimental Evidence of the Semiconductor Nature of the Compounds CdTe and In_2Te_3.—J. Appel. (*Z. Naturf.*, March 1954, Vol. 9a, No. 3, pp. 265–267.) Measurements were made of the conductivity of polycrystalline specimens over the range from room temperature to 900°K for In_2Te_3 and to 1 100°K for CdTe. Practical details are given of the preparation of the specimens and of the test set-up. Results are shown graphically; several activation levels are distinguished and their significance discussed.

537.311.33 : 546.682.86 **1073**

Optical and Photo-Electrical Properties of Indium Antimonide.—D. G. Avery, D. W. Goodwin, W. D. Lawson & T. S. Moss. (*Proc. phys. Soc.*, 1st Oct. 1954, Vol. 67, No. 418B, pp. 761–767.) "Measurements have been made of the refractive index and absorption index of InSb by reflection methods with polarized radiation. Extensive studies of absorption constant have been made by direct transmission measurements. Both photovoltaic and photoconductive effects have been observed in InSb. At room temperature the photosensitivity extends to approximately 7·5μ, a considerably longer wavelength than for any other known material."

537.311.33 : 546.682.86 **1074**

The Interpretation of the Properties of Indium Antimonide.—T. S. Moss. (*Proc. phys. Soc.*, 1st Oct. 1954, Vol. 67, No. 418B, pp. 775–782.) Results of measurements by Avery et al. (1073 above) are analysed and precise values are determined for the position and temperature dependence of the optical absorption edge. The variation of the position of the absorption edge with impurity concentration is explained by the very low effective mass of the conduction electrons, which is estimated by three methods to be about 0·03 of the free electron mass.

537.311.33 : 546.811-17 **1075**

Formation of Compact Pieces of Grey Tin.—L. J. Groen. (*Nature, Lond.*, 30th Oct. 1954, Vol. 174, No. 4435, p. 836.) Experiments are reported which indicate that the presence of mercury encourages the transformation of ordinary tin into grey tin. Pieces measuring several centimetres in length and 0·5 cm in thickness have been obtained.

537.311.33 : 546.811-17 **1076**

Germanium-Stabilized Gray Tin.—A. W. Ewald. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1436–1437.) Experiments indicate that grey tin containing 0·75% Ge does not appreciably revert to the metallic state unless the temperature is above 60°C.

538.221 **1077**

The ΔE-Effect, Young's Modulus, and Magnetic Properties in Ferromagnetic Nickel-Copper Alloys.—M. Yamamoto. (*Sci. Rep. Res. Inst. Tohoku Univ.*, *Ser. A*, Oct. 1954, Vol. 6, No. 5, pp. 446–457.) Measurements made at ordinary temperatures on alloys containing up to about 35%Cu are reported, using magnetostrictive-oscillation and ballistic methods.

538.221 **1078**

On a New Anomaly in the Alloys of Nickel and Cobalt: Part 2—The Cause for the Effect of Magnetic Anneal.—H. Masumoto, H. Saito & T. Shioya. (*Sci. Rep. Res. Inst. Tohoku Univ., Ser. A*, Oct. 1954, Vol. 6, No. 5, pp. 462–468.) Results of experiments indicate that the magnetic annealing effect produced by treating the specimen in a comparatively weak field, and manifested in the rectangular hysteresis curve, is more marked in wire specimens than in ring specimens. The effect is observed over the temperature range between the magnetic transformation point and about 400°, being most marked at about 650° for an alloy containing 65% Co. From measurements of magnetization at high temperatures with the specimens treated in various ways, it is concluded that the effect may be connected with plastic flow due to magnetostriction.

538.221 : 669.14.018.583 **1079**

Improvement of Magnetic Characteristics of Transformer Iron by means of Electrochemical Processing.—S. Ya. Grilikhes. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1786–1787.) Improvements obtained are (*a*) a 10–15% increase of the permeability and (*b*) a 10% decrease in hysteresis losses.

539.234 : 546.121.3 : 548.7 **1080**

Structure of Thin Films of Alkali Halides evaporated on to Single-Crystal Substrata.—H. Lüdemann. (*Z. Naturf.*, March 1954, Vol. 9a, No. 3, pp. 252–259.)

546.86 : 548.7 **1081**

Structure of Amorphous Antimony.—H. Richter, H. Berckhemer & G. Breitling. (*Z. Naturf.*, March 1954, Vol. 9a, No. 3, pp. 236–252.)

621.315.612.4 : 546.431.824-31 **1082**

Properties and Applications of Dielectrics containing Barium Titanate.—H. Lennartz. (*Funk u. Ton*, Oct. 1954, Vol. 8, No. 10, pp. 537–548.) The physical properties and engineering applications in capacitors, transducers, dielectric amplifiers and modulators are surveyed. 45 references.

621.315.612.6 **1083**

Pressed and Sintered Glass Powder Shapes.—W. H. McKnight. (*Mater. & Meth.*, Oct. 1954, Vol. 40, No. 4, pp. 94–96.) Cold-working technique is described for forming intricately shaped glass parts from powdered material. The sintered material is opaque and has essentially the same electrical properties as the original glass. An advantage as regards use for electrode mounts in evacuated tubes is the absence of trapped gas bubbles.

621.315.616 **1084**

Some Data on Recently Developed Insulating Materials.—H. Nigg. (*Bull. schweiz. elektrotech. Ver.*, 30th Oct. 1954, Vol. 45, No. 22, pp. 923–928. In French.) Properties of silicone rubbers, solid and cellular polyethylene, teflon and hostaflon are reported briefly.

621.315.616 **1085**

Properties of Plasticizers and their Relation to Electrical Compounding.—J. J. Morris & W. J. Canavan. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, pp. 1018–1020.)

621.318.2 : 621.317.7 **1086**

High-Coercive-Force Permanent-Magnet Materials and their Application.—T. O. Paine & L. I. Mendelsohn. (*Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, pp. 891–895.) A brief review of materials and their application in moving-coil instruments is given. 18 references.

666.1.037.5 : [546.821 + 546.831 **1087**

The Glass-Sealing Properties of Titanium and Zirconium.—H. Rawson & E. P. Denton. (*Brit. J. appl. Phys.*, Oct. 1954, Vol. 5, No. 10, pp. 352–353.) "Titanium and zirconium may be sealed to standard sealing glasses without the need for any special sealing techniques, to give strong vacuum-tight seals with low stresses in the glass. If a flame-sealing method is used it is necessary to keep the sealing time as brief as possible, since the expansion characteristics of both metals change appreciably on prolonged heating in air."

MATHEMATICS

517.942.9 **1088**

The Meaning of the Vector Laplacian.—H. K. Farr: P. Moon & D. E. Spencer. (*J. Franklin Inst.*, Sept. 1954, Vol. 258, No. 3, pp. 213–216.) Comment on 1844 of 1954 and authors' reply.

518.61 **1089**

A String-Net Analog for the Numerical Solution of the Equations of Laplace and Poisson.—P. L. Tea. (*J. Franklin Inst.*, Oct. 1954, Vol. 258, No. 4, pp. 287–303.) The string-net surface for a given problem is the same as that obtained by the relaxation method, but is determined more easily.

519.2 **1090**

The Statistics of Scaled Random Events.—R. O. Davies & J. W. Leech. (*Proc. Camb. phil. Soc.*, Oct. 1954, Vol. 50, Part 4, pp. 575–580.) "When independent random events are scaled down by a factor n, the number of counts in a given time interval no longer obeys the Poisson Law. The correct distribution function is derived together with its moment-generating function and explicit formulae ($n = 2, 4$) for the first four moments about the mean. The theory is in agreement with experiments carried out with a scale-of-four counter. A more general treatment is given and is applied to find the variance for all even values of n."

517 **1091**

Les Fonctions Orthogonales dans les Problèmes aux Limites de la Physique Mathématique. [Book Review]—T. Vogel. Publishers: Éditions du Centre National de la Recherche Scientifique, Paris, 1953, 192 pp., 1200 fr. (*Nature, Lond.*, 9th Oct. 1954, Vol. 174, No. 4432, p. 668.) Chapters of this monograph are devoted to (*a*) general properties of orthogonal functions and differential systems including perturbed systems, (*b*) particular closed series, e.g. Fourier, and (*c*) applications to particular problems including those involving the wave equation with boundary conditions.

MEASUREMENTS AND TEST GEAR

621.314.7.001.4 **1092**

Testing Point-Contact Transistors for Pulse Applications.—R. L. Wooley. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, pp. 981–987.) A set of d.c., static and dynamic parameters is chosen that suffices to define transistor switching action in each of the three operating regions [652 of 1953 (Anderson)]. D.c.

measurements include (*a*) reverse emitter and collector resistance, (*b*) reverse collector current, (*c*) base resistance, (*d*) saturation collector voltage and (*e*) d.c. gain. Static measurements of the V_E/I_E and V_C/I_C characteristics with I_C and I_E as the respective parameters are required. Dynamic measurements include (*a*) current-gain/emitter-current characteristic, (*b*) frequency response, either as a current-gain/frequency characteristic or by a pulse method. Measurement methods are specified and necessary precautions are noted. A table of typical measurement results and specifications is also given.

621.317.1 : 519.282 **1093**

Instrumental Drift.—W. J. Youden. (*Science*, 22nd Oct. 1954, Vol. 120, No. 3121, pp. 627–631.) A scheme of measurement is described by means of which the errors due to the drift of the measuring instrument can be determined by statistical analysis of the observed readings. References to more detailed discussions of analysis and design of experiments are given.

621.317.3 : 621.396.722 **1094**

Banbury Radio Measuring Station.—P. N. Parker & G. Gregory. (*P. O. elect. Engrs' J.*, Oct. 1954, Vol. 47, Part 3, pp. 143–147.) Account of the equipment and work of this Post Office station, whose main function is to collect information on reception conditions in relation to the international planning of radio services.

621.317.3.029.6 : [621.372.2 + 621.372.87 **1095**

The Multiple-Short-Circuit Plunger Technique for the Determination of the Transformation Properties of Lossless 2*n*-Terminal Networks between Homogeneous Transmission Lines.—H. Lueg. (*Arch. elekt. Übertragung*, Oct. & Nov. 1954, Vol. 8, Nos. 10 & 11, pp. 457–466 & 513–522.) The method described by Weissfloch (2850 of 1954) and applied to six-terminal waveguide junctions (322 of February) is extended to 2*n*-terminal junctions, for which case it is possible, when the initial positions of the *n*–1 short circuits are suitably chosen, to adjust them simultaneously so that the voltage node on the input line moves according to a prescribed curve. Input impedance can be determined directly for any given terminating impedance. The conditions under which the method is applicable are defined in terms of the number of discontinuities passed through in moving the *n*–1 short-circuits over a distance $\lambda/2$ towards the junction. A detailed description is given of the method applied for a lossless eight-terminal junction. For junctions of higher order Stein's reduction method (1673 of 1954) can be applied in conjunction with the double and triple short-circuit techniques described.

621.317.335.3 **1096**

Errors occurring in the Measurement of Dielectric Constant.—R. F. Field. (*ASTM Bull.*, Oct. 1954, No. 201, p. 30.) Discussion of the accuracies attainable using the guard-electrode, micrometer-electrode or wire-connector methods to eliminate errors due to the finite extent of the specimen.

621.317.335.3.029.64 **1097**

Quick Method of Calculation of Complex Dielectric Constant at Centimetre Wavelengths (Method using Rod Samples).—S. Le Montagner, J. Le Bot, S. Chauvin & R. Haye. (*C. R. Acad. Sci., Paris*, 29th Nov. 1954, Vol. 239, No. 22, pp. 1474–1476.) Nomograms are discussed for use with the method of measurement described previously [2067 of 1953 (Le Bot & Le Montagner)].

621.317.337 + 621.317.411] : 621.3.042.12 **1098**

Measurement of Quality Factors of Inductor Cores.—C. Stewart. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 1017.) Summary of paper published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954. If two coils having negligible winding capacitance are wound on a ring-shaped core the permeability and *Q* can be determined from mutual-impedance measurements. The materials considered have low loss and are used at low flux densities. A new bridge circuit not including inductors was designed to avoid the limitations of standard bridge circuits.

621.317.341 **1099**

The Measurement of Speech Level.—J. N. Shearme & D. L. Richards. (*P. O. elect. Engrs' J.*, Oct. 1954, Vol. 47, Part 3, pp. 159–161.) Measurement difficulties due to the fragmentary nature of speech in telephone conversations are discussed. An instrument for laboratory use which eliminates observer errors has a 'pointer-function' circuit replacing the usual moving-coil meter and giving an output which is the electrical counterpart of the meter deflection. This output is connected to a potential divider having 12 outputs at 1-db intervals, each of these being connected to a pulse trigger.

621.317.352 : 621.372.8 **1100**

Experimental Study of Circular Waveguides using the TE_{01} Mode in the Vicinity of 25 000 Mc/s.—G. Comte & J. M. Paris. (*Câbles & Transm.*, Oct. 1954, Vol. 8, No. 4, pp. 311–324.) Continuation of 1068 of 1953 (Comte & Ponthus). Descriptions are given of test equipment and of attenuation measurements on short sections (*a*) for varying guide diameter, and (*b*) for various treatments of the internal surface. Resonance measurements on medium-length straight and curved guides were also made. Results were in satisfactory agreement with theory; in particular Jouguet's formula (948 of 1949) was verified. Electrolytic polishing gives results in best accord with theory.

621.317.4 **1101**

A New Electrodynamic Method of measuring Magnetic Fields.—S. K. D. Roy. (*Indian J. Phys.*, April 1954, Vol. 28, No. 4, pp. 183–190.) The method is based on measuring the maximum couple exerted on a small current-carrying coil suspended in the field.

621.317.7 : 621.372.5.012 **1102**

An Electronic Nyquist Diagram Plotter.—J. L. Douce. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 32–34.) A unit incorporating 16 pentodes and 15 diodes is described, by means of which the gain of a network is found from a pair of voltages representing respectively the in-phase and out-of-phase components. A c.r.o. display is provided. A frequency range from about 1 c/s to about 10 kc/s can be covered.

621.317.7.085.4.089.6 **1103**

The Calibration of Circular Scales and Precision Polygons.—A. H. Cook. (*Brit. J. appl. Phys.*, Oct. 1954, Vol. 5, No. 10, pp. 367–371.)

621.317.725 : 621.314.67 **1104**

Shunt-Diode Rectifier in Voltage Measurement.—M. G. Scroggie. (*Wireless Engr*, Feb. 1955, Vol. 32, No. 2, pp. 53–60.) Analysis indicates that the reduction of rectification efficiency due to series source resistance is the same for the simple shunt-diode arrangement as for the series-diode arrangement. This is supported by experimental evidence. The effect of the source resistance is reduced by augmenting the diode resistance. The effect of including *RC* filters is also discussed.

621.317.725.089.6 **1105**

Determination of the D.C./A.C. Transfer Error of an Electrostatic Voltmeter.—W. E. Smith & W. K. Clothier. (*Proc. Instn elect. Engrs*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 465–469.)

621.317.729 **1106**

Equipotential Plotting Table.—E. B. Dahlin. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, pp. 951–953.) Description of equipment using the electrolytic properties of ordinary paper with painted-on graphite electrodes to which a direct voltage of 1 kV is applied. Using an electrode spacing of about 30 cm, a desired equipotential line can be located accurately to within 0·1 mm.

621.317.733 **1107**

The Bridged-T Element as a Measurement Bridge.—W. Herzog. (*Arch. elekt. Übertragung*, Oct. 1954, Vol. 8, No. 10, pp. 436–438.) Basic theory of the system is given and methods of measuring inductance and of determining the effective capacitance of a resistor are outlined. Advantages of the circuit are (*a*) input and output may be directly earthed; (*b*) wide range of adjustment, e.g. in measuring inductance $L \propto 1/C^3$ where C is the capacitance in each of the T-network arms.

621.317.733 **1108**

Workshop *RC* Bridge.—B. T. Gilling. (*Wireless World*, Feb. 1955, Vol. 61, No. 2, pp. 80–82.) Details are given of an instrument incorporating a 1-kc/s source, a bridge indicator comprising two-valve amplifier and meter, and a leakage indicator for testing electrolytic capacitors.

621.317.733 : 621.385.032.216 **1109**

A Bridge for the Measurement of Cathode Impedance.—R. M. Matheson & L. S. Nergaard. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 485–505.) Details are given of a simple bridge in which the impedance of an unknown diode is compared with that of a standard diode, on the basis of an equivalent diode circuit comprising e.m.f. in series with parallel R and C in the cathode lead. Results obtained over a considerable period of use are discussed. The method does not distinguish between the impedance of the oxide coating and that of the interface.

621.317.733.029.64 : 621.317.335 **1110**

Microwave Interferometer.—S. K. Chatterjee, C. Rama Bai & P. R. Shenoy. (*J. Indian Inst. Sci.*, Section B, Oct. 1954, Vol. 36, No. 4, pp. 172–192.) Description of the design and operation of a two-beam interferometer for studying the properties of dielectrics at $\lambda = 3{\cdot}2$ cm. The instrument is essentially a bridge, one arm consisting of a free-space path into which the sample is inserted. Microwave power from a klystron, modulated with a 1-kc/s square wave, is projected on to the sample from a horn, and the transmitted power is received by a second horn and combined in a hybrid junction with a fraction of the input transmitted by waveguide. A crystal detector records the energy minima and maxima as the receiving horn is displaced along its axis. Results of measurements on some solid insulating materials are reported. Diffraction effects are discussed in relation to sample size.

621.317.755 : 621.383.2 **1111**

Photoelectric Comparator for Measuring Oscillograms.—H. B. Phillips. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, pp. 971–976.) The centre line of a waveform photographed from a c.r.o. trace is located accurately and rapidly by means of a balancing arrangement involving an optical beam splitter and two photocells.

621.317.755.029.6 **1112**

New System for Feeding a Pulse Oscillograph.—I. S. Stekol'nikov, A. Ya. Inkov & A. M. Chernushenko. (*C. R. Acad. Sci. U.R.S.S.*, 21st Oct. 1954, Vol. 98, No. 6, pp. 969–972. In Russian.) A h.v. power-supply circuit for a high-speed c.r. oscilloscope is described. Square pulses of amplitude ~ 7 kV are produced in an LC ladder network by means of a 'trigatron' tube. The pulse voltage is stepped up to ~ 40 kV by a bifilar autotransformer, the two windings of which also serve as leads for the heater supply. The cathode voltage is thus kept at –40 kV for about 1 μs, less negative voltages for the anodes being provided by use of a potential divider between cathode and earth. Traces obtained with 150-Mc/s and 3-kMc/s signals are shown. In the latter case, the writing speed is about 340 000 km/s.

621.317.761.029.3 **1113**

An Audio-Frequency Meter.—P. G. M. Dawe & J. A. Deutsch. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 2–6.) The instrument described was designed for investigating frequency variations of the human voice, and produces a direct voltage proportional to input frequency. A square wave of input frequency is used to fix the voltage attained by a pair of capacitors, the operating principle being similar to that used by Barker & Connon (221 of 1954) and Andrew & Roberts (817 of March). The output actuates a pen recorder. Frequency ranges of 90–180 and 180–360 c/s are covered.

621.373 : 621.387 **1114**

A Low-Frequency Pulse-Train Generator.—J. E. Flood & J. B. Warman. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 13–16.) The pulse generator uses multi-cathode gas-filled counter valves to produce pulses whose make-to-break ratio can be adjusted between 1 : 99 and 99 : 1 in steps of one per cent with an accuracy within one part per thousand. The pulse repetition frequency covers the range 5 to 50 c/s with an accuracy determined entirely by the external oscillator used to drive the pulse generator. The pulses can be sent continuously or in trains of from 1 to 11 pulses.

621.397.62.001.4 **1115**

Measurements on Television Receivers: Part 6—Measurements of Linearity, Sensitivity and Selectivity in the Video and Sound Channels.—O. Macek. (*Arch. tech. Messen*, Oct. 1954, No. 225, pp. 235–238.) Part 5: 567 of February.

53.08 **1116**

The Physics of Experimental Method. [Book Review]—Braddick. (See 1010.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

550.837 **1117**

Direct Electromagnetic Effect of Alternating Radiators in Homogeneous Ground.—A. Belluigi. (*Ann. Geofis.*, July 1954, Vol. 7, No. 3, pp. 415–440.) Theory relevant to geophysical prospecting is developed. It is deduced that at very low frequencies the field strength must be increased and the propagation velocity of the e.m. waves must be reduced to the order of magnitude of the velocity of seismic waves.

620.179 : 534.321.9 **1118**

Ultrasonic Thickness Gauging on Ships' Plates.—(*Elect. J.*, 22nd Oct. 1954, Vol. 153, No. 17, pp. 1281–1283.) Description of Dawes Type 1101 portable gauge for measuring wall thickness where only one side is accessible. It incorporates a computing mechanism, so that once the calibrating ring has been set to the velocity of sound in the material under test, the wall thickness is read off directly.

621.316.7 **1119**

Sampled-Data Processing for Feedback Control.—A. R. Bergen & J. R. Ragazzini. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 980.) Summary of paper published in *Trans. Amer. Inst. elect. Engrs*, Part II, *Applications and Industry*, 1954.

621.317.39.029.6 : 621.372.413 **1120**

A Method of using Microwaves for measuring Small Displacements, and a Torque-Meter using this Principle.—N. C. de V. Enslin. (*Proc. Instn elect. Engrs*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 522–528. Discussion, pp. 535–540.) Methods based on the relation between the resonance frequency and the dimensions of a cavity are described.

621.384.611 **1121**

Orbital Periods in the Microtron.—H. F. Kaiser. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, pp. 1025–1026.)

621.384.612 : 621.373.4 **1122**

The Radio-Frequency System of the Birmingham Proton Synchrotron.—L. U. Hibbard. (*J. sci. Instrum.*, Oct. 1954, Vol. 31, No. 10, pp. 363–371.) In this system the frequency is varied from 330 kc/s to 9·3 Mc/s in 1 sec by means of a servo-controlled beat-frequency oscillator, and is made to track the rising magnetic field with an error not greater than ± 0·1% at the beginning and ± 1% at the end of a cycle. The r.f. potential applied to the cee is 240 V r.m.s.

621.384.62 **1123**

Recent Developments in Van de Graaff Generators.—W. D. Allen. (*Instrum. Practice*, Oct. 1954, Vol. 8, No. 10, pp. 872–879.) Problems involved in the vacuum-tube development are considered; ion sources, stabilization and beam ducting are also discussed.

621.384.622.1 **1124**

Simple Theoretical Model for studying the Motion of Ions in a Linear Accelerator.—M. Y. Bernard. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, pp. 121A–132A.)

621.384.622.2 : 621.372.8 **1125**

Experimental Study of Waveguide with [internal] **Helix for Linear Proton Accelerator: Shunt Impedance.**—Septier. (See 928.)

621.384.622.2 : 621.372.8 **1126**

Experimental Study of Waveguide with [internal] **Helix for Linear Accelerator for Heavy Particles: Phase Velocity.**—Septier. (See 927.)

621.385.833 **1127**

Some Types of Electrostatic Immersion Objective with High Magnification.—A. Septier. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 374–410.) Detailed experimental and theoretical study of design and operating conditions.

621.385.833 **1128**

Distortion in Electron Lens.—M. L. De & D. K. Saha. (*Indian J. Phys.*, June 1954, Vol. 28, No. 6, pp. 263–268.) A modification of Hillier's method (3381 of 1946) of measuring the amount of distortion in different zones of the image field at low magnifications is explained. Distortion is plotted against radial distance from the optic axis. The magnification was also measured, and the coefficient of distortion computed graphically.

621.387.424 **1129**

Behaviour of Geiger-Müller Counters with External Graphiting when dealing with High Courts.—D. Blanc. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, pp. 693–694.)

621.387.424 **1130**

Production of Oscillations in Halogen-Quenched G.M. Counters.—D. H. Le Croissette. (*Rev. sci. Instrum.*, Oct. 1954, Vol. 25, No. 10, p. 1023.)

621.396.9 : 621.315.232 **1131**

Apparatus for locating Buried Cables and identifying Individual Cables in Common Ducts.—K. Buchmann. (*Bull. schweiz. elektrotech. Ver.*, 2nd Oct. 1954, Vol. 45, No. 20, pp. 838–841.) The e.m. field of a 300–1 000-c/s signal applied between the core of the cable to be identified and earth is detected by means of a search coil followed by a simple l.f. amplifier. A 50-mA current in the cable can be detected at distances up to 5–10 m, and the position of the cable can be determined by taking bearings at several points as in h.f. direction finding.

77 : 537.22 **1132**

"Electrofax" Direct Electrophotographic Printing on Paper.—C. J. Young & H. G. Greig. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 469–484.) Electrofax paper is ordinary paper with a thin coating of ZnO in a resin binder. It is sensitized by placing a negative e.s. charge on the coating in the dark, e.g. by ion transfer from a corona discharge. On exposure, the charge is lost in the exposed areas and retained in the masked area. The image is developed by applying a pigmented resin powder carrying a positive charge. The process can be used to make enlargements. Spectral response of the paper and details of the various steps in the procedure are discussed.

621.387.464 : 535.37 **1133**

Scintillation Counters. [Book Review]—J. B. Birks. Publishers: Pergamon Press, London, 1953, 148 pp., 21s. (*Nature, Lond.*, 30th Oct. 1954, Vol. 174, No. 4435, p. 810.) The book gives a summary of recent work and a picture of the present state of the art. The longest single chapter is devoted to organic crystalline phosphors.

PROPAGATION OF WAVES

538.566 **1134**

On Linearly Polarized Electromagnetic Waves of Arbitrary Form.—A. Nisbet & E. Wolf. (*Proc. Camb. phil. Soc.*, Oct. 1954, Vol. 50, Part 4, pp. 614–622.) "Two simple laws connecting the amplitude and phase functions of a monochromatic electromagnetic wave of arbitrary form are derived, holding in the case when one of the field vectors is linearly polarized. The first is a generalized Fermat's principle which enables determination of the phase when the amplitude is known; the second expresses the propagation of the (vector) amplitude along the curves orthogonal to the co-phasal surfaces. Some other general properties of linearly polarized fields are also discussed, and illustrative examples are given."

538.566 : 538.63 : 537.56 **1135**

Deduction of Appleton's Ionospheric Double-Refraction Formula from the Non-Maxwellian Magneto-ionic Theory. Conditions and Range of Validity.—R. Jancel & T. Kahan. (*J. Phys. Radium*, Oct. 1954, Vol. 15, No. 10, pp. 696–697.) The double-refraction formula is deduced from theory presented previously (3196 of 1954 and back references).

621.396.11 **1136**

Radio Scattering in the Troposphere.—W. E. Gordon. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 23–28.) Theory presented previously [1757 of 1950 (Booker & Gordon)] is modified in the light of subsequent observations of turbulence in the troposphere, as indicated by fluctuations of refractive index, and is applied to the investigation of radio fading problems. Required spacing of diversity receivers is deduced from the scattering volume. An upper limit is found for the size of an aerial to be able to yield its full theoretical gain in the presence of scattering. An estimate is made of the frequency bandwidth over which radio signals will be correlated at a single receiving site well beyond the radio horizon.

621.396.11 **1137**

Observation of Scatter Echoes on High-Power Pulsed Transmissions.—S. N. Mitra & V. C. Iyengar. (*Indian J. Phys.*, April 1954, Vol. 28, No. 4, pp. 147–166.) Report of observations made at Delhi during Nov. 1950 and May–June 1951, mainly at 21·7 Mc/s, using a 100-kW pulsed directional transmitter. Six types of scatter pattern are distinguished, a graph showing the relation of each type to total path and angle of incidence. Statistical analysis of observations shows that the most frequently occurring scatter pattern involved propagation via the E layer and scattering at the ground. Night and day ranges differed by about 100 km. Using directional aerials, the main ground scatter source was located in the mountainous area of the N.W. Frontier province.

621.396.11 **1138**

Oblique-Incidence Pulse Transmission.—J. W. Cox & K. Davies. (*Wireless Engr*, Feb. 1955, Vol. 32, No. 2, pp. 35–41.) A report is given of observations of transmissions over the 2 360-km path between Ottawa and Saskatoon, made during the summer of 1949. Each station was provided with a transmitter and receiver continuously and independently variable over the frequency range 2–25 Mc/s. 10-kW pulses of 50-μs duration were transmitted at the rate of 25 per sec. In the first set of experiments the two transmitters kept on the same frequency, changing once per minute by 100-kc/s steps. In the second set of experiments, one transmitter was maintained at constant frequency while the other was varied. Records obtained during quiet and during disturbed conditions are reproduced, showing N-type echoes, scatter propagation at frequencies about the m.u.f. and spread echoes. No departures from reciprocal conditions were observed. Millington's oblique-incidence theory was verified by converting vertical-incidence *h'f* records to equivalent oblique-incidence records and comparing these with observations. The Sellmeyer dispersion formula was found to be more accurate than the Lorentz formula for calculating m.u.f.

621.396.11 : 551.510.535 **1139**

A Reciprocity Theorem on the Propagation of Radio Waves via the Ionosphere.—K. G. Budden. (*Proc. Camb. phil. Soc.*, Oct. 1954, Vol. 50, Part 4, pp. 604–613.) It is proved that, for a horizontally stratified ionosphere and for a transmission path in the magnetic meridian, the reciprocity theorem for electrical systems applies (*a*) when the transmitting and receiving aerials both radiate or receive waves whose electric vector is in the plane of incidence, and (*b*) when both aerials radiate or receive waves whose electric vector is horizontal. If the electric vector radiated or received is horizontal for one aerial and in the plane of incidence for the other, then there is reciprocity in signal amplitude, but the phase changes for transmission in the two directions differ by 180°. These results are valid for any law of variation of electron density and collision frequency with height. They are based on a 'full-wave' theory, and therefore apply to all frequencies. They are unaffected if the path includes multiple reflections, and if allowance is made for the curvature of the earth.

621.396.11.029.45 : 551.594.6 **1140**

Very-Low-Frequency Noise Power from the Lightning Discharge.—Barlow, Frey & Newman. (See 1044.)

621.396.11.029.55 **1141**

Observed Diurnal Variations in Frequencies and Signal Qualities between New York and Central Europe.—J. H. Nelson. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 602–606.) Data on the highest and lowest frequencies received at New York during the badly disturbed month of November 1953 are shown in charts for five different times during the day, the optimum working frequency predicted by the C.R.P.L. being shown for comparison. Consideration of these charts and corresponding ones covering a period of four years indicates that during ionospheric storms the optimum frequencies tend to be below predicted values, while during ionosphere calm periods the optimum frequencies tend to be above predicted values. For satisfactory operation, the communication engineer needs four staggered frequencies for each day, with additional frequencies to take account of yearly and eleven-yearly ionosphere variations.

621.396.11.029.55 : 551.594.5 **1142**

Doppler-Shifted Radio Echoes from Aurorae.—Bowles. (See 1043.)

621.396.812.3 : 621.317.087.4 **1143**

Peak Amplitude Recorder for Investigation on Fading.—S. C. Mazumder & S. N. Mitra. (*Indian J. Phys.*, June 1954, Vol. 28, No. 6, pp. 251–255.) The recorder includes a conventional gating circuit, so that any particular echo in the pulse echo train can be selected, and its amplitude recorded. Circuit diagrams are given, and operation is discussed.

RECEPTION

621.396.62 + 621.397.62] : 061.4 **1144**

26th Swiss Radio and Television Exhibition [August 1954].—(*Bull. schweiz. elektrotech. Ver.*, 2nd Oct. 1954, Vol. 45, No. 20, p. 862.) A brief account is given of the main trends noted in domestic radio and television receiver design.

621.396.62 : 621.396.822 **1145**

Spectral Response of a Quadratic Device to Non-Gaussian Noise.—T. A. Magness. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1357–1365.) A method of computation based on a fourth-order moment P of the input noise is discussed, P being a function of three independent time delays. The difference between the value of P for a non-Gaussian noise and that for a Gaussian noise with the same frequency range is expressed as a function P_1 whose Fourier transform, Q_1, a function of three frequencies, is capable of interpretation in terms of nonlinear correlations between noise components at different frequencies. A specialization of Q_1 leads to E, a function of two frequencies, which is a measure of the correlation between the squares of the envelopes associated with those frequencies. "Several networks involving quadratic nonlinear elements are examined to illustrate the theory. It is shown that while the function P makes it possible to compute the complete spectral response of the network the function E (together with the spectrum of the input) is sufficient in order to find the spectral density at zero frequency. Finally, for three examples of non-Gaussian processes, the corresponding P_1, Q_1 and E functions are computed."

621.396.82 : 621.376.3 **1146**

Frequency-Modulation Interference Rejection with Narrow-Band Limiters.—E. J. Baghdady. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 51–61.) A theoretical investigation is made of the minimum values of limiter and discriminator bandwidth required in a f.m. receiver to enable the weaker of two incoming signals to be suppressed. The values found are considerably lower than those given by Arguimbau & Granlund (734 of 1950). The possibility is discussed of reducing the discriminator bandwidth requirement to that of the i.f. stage by cascading band-pass filters.

621.396.823 + 621.397.823 **1147**

Ignition Interference at Frequencies below 100 Mc/s: the Mechanism of its Production.—Newell. (See 1187.)

621.396.828 : [621.396.44 : 621.315.052.63 **1148**

Radio Transmission on 230- and 400-kV Lines.—B. G. Rathsman, S. Parding & C. A. Enstrom. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, Aug. 1954, Vol. 73, pp. 1037–1040. Digest, *Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 1022.) Radio interference from h.v. lines in Sweden was suppressed by transmitting programmes directly over the interfering lines. A graph shows signal-level/distance for a transmitter output power of 2 × 125 W and a frequency of 182 kc/s. A formula is given for computing the output power required to keep the signal level at least 35 db above the interference level over any required distance.

STATIONS AND COMMUNICATION SYSTEMS

621.376.5 **1149**

Spectra of Modulated Pulse Trains.—A. Sabbatini. (*Alta Frequenza*, Oct. 1954, Vol. 23, No. 5, pp. 255–277.) Analysis is presented first for trains of unmodulated pulses; the spectrum consists of one or more Fourier series. It is not possible to make an accurate determination of the spectrum of the modulated pulses directly from that of the unmodulated pulses by considering the modulation to be applied to the individual components. The spectrum resulting from modulation by a single sinusoidal signal comprises a double infinite series of lines; the frequency band is not widened, but the lines are more closely spaced, with corresponding reduction of intensity.

621.39.001.11 **1150**

Coding to achieve Markov Type Redundancy.—J. E. Flanagan. (*J. Math. Phys.*, Oct. 1954, Vol. 33, No. 3, pp. 258–268.)

621.39.001.11 : 519.272.1 **1151**

On the Concept of an Instantaneous Power Spectrum, and its Relationship to the Autocorrelation Function.—C. H. M. Turner. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1347–1351.) The expression derived by Page (2326 of 1952) to represent instantaneous power spectra is compared with other possible representations obtained by assuming different observers starting their observations at different times: the results differ by complementary functions. A 'running autocorrelation function' is defined; Page's instantaneous power spectrum is equal to the Fourier transform of the time rate of change of this function.

621.395.44 **1152**

48-Channel Carrier-Current Network for Denmark.—J. D. Christensen & A. Hillestrøm. (*Teleteknik, Copenhagen*, Oct. 1954, Vol. 5, No. 3, pp. 283–341.)

621.396 : 621.372.5 **1153**

Radio-Frequency Phase-Difference Networks: a New Approach to Polyphase Selectivity.—G. B. Madella. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 102–103.) Comment on 1910 of 1954 (Cifuentes & Villard).

621.396.1 **1154**

International Frequency Allocations and their Effects on Industry.—J. M. Dobbyn. (*Proc. Instn Radio Engrs, Aust.*, Nov. 1954, Vol. 15, No. 11, pp. 276–284.) "Following a brief review of the history of international radio conferences, the important factors governing the allocation of channels by the Provisional Frequency Board, the Extraordinary Administrative Radio Conference of 1951 and Region 3 are discussed. The effects of the required frequency changes on the radio industry are examined."

621.396.43 : 621.396.65 **1155**

Radio Beam Links with Large Transmission Capacity.—W. Klein. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1954, Vol. 32, No. 10, pp. 381–397. In German.) The recognition on the one hand of a physical limit for the beam concentration, and on the other hand of an economic limit for the size of the aerial, leads to a choice of wavelength giving a best compromise under ideal propagation conditions. In practice the choice is influenced also by fading conditions and by the power of the available valves. The influence of the ground and of the troposphere on propagation is discussed qualitatively. Various transmission systems are compared, including p.c.m. systems; network planning considerations are closely similar for them all.

621.396.44: 621.315.052.63 : 621.396.828 **1156**

Radio Transmission on 230- and 400-kV Lines.—Rathsman, Parding & Enstrom. (See 1148.)

621.396.63 **1157**

Automatic Alarm Device for CONELRAD Radio Alerting.—R. B. Carey. (*Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, pp. 963–965.) A device for use in conjunction with a broadcast receiver. A part of the receiver i.f. voltage is rectified and used as positive bias to overcome a fixed negative bias on a pentode valve. Any interruption of the signal, whether due to an alert or to a failure in the alarm or receiver circuit, results in an alarm indication.

621.396.722 : 621.317.3 **1158**

Banbury Radio Measuring Station.—Parker & Gregory. (See 1094.)

621.396.931 **1159**

Technical Planning of a Swiss Mobile Telephone Network.—E. Wey. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Oct. 1954, Vol. 32, No. 10, pp. 398–405. In French and German.) Experimentally determined field-strength distributions of transmitters at Chasscral and Säntis are used as basis for planning the system. The calling method, the ultimate capacity of the system, and the design of suitable superregenerative receivers are discussed.

621.396.932 **1160**

U.S.W. Radio for Pilotage, Harbour and Coastal Services.—Mailandt. (*Telefunken Ztg*, Sept. 1954, Vol. 27, No. 105, pp. 138–144.) Radio communication facilities and equipment provided for pilots are discussed in general terms from the user's point of view. Duplex operation is preferred.

SUBSIDIARY APPARATUS

621-526 **1161**

An Equalizing Network for Carrier-Type Feedback Control Systems.—C. H. Looney. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 20–22.) "The analysis of an active, high Q, RLC circuit shows that it permits lag compensation of carrier-type feedback control systems through direct operation on the system actuating signal. The use of this circuit in an instrument type velocity servo reduces the steady state error by a factor of at least 30."

621-526 **1162**

The Minimum-Moment-of-Error-Squared Criterion: a New Performance Criterion for Servo Mechanisms.—J. H. Westcott. (*Proc. Instn elect. Engrs*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 471–480. Discussion, pp. 488–492.)

621-526 **1163**

The Behaviour of a Remote-Position-Control Servo Mechanism with Hard-Spring Non-Linear Characteristics.—J. C. West & P. N. Nikiforuk. (*Proc. Instn elect. Engrs*, Part II, Oct. 1954, Vol. 101, No. 83, pp. 481–488. Discussion, pp. 488–492.)

621.311.6 : 537.311.33 : [539.16 + 535.215 **1164**

Radioactive and Photoelectric *p-n* Junction Power Sources.—W. G. Pfann & W. van Roosbroeck. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1422–1434.) "An electrical power source can be made by exposing a *p-n* junction to radioactivity or light, so that the junction field separates electron-hole pairs produced by the radiation. Expressions for maximum power, optimum load resistance, and efficiency are derived from an equivalent circuit and rectification theory. Power and efficiency increase with source current I_g of separated charges and zero-bias junction resistance. I_g increases with energy and intensity of radiation, but is limited by self-absorption in the radioactive isotopes. Estimates of attainable power and efficiency for silicon cells are 3.10^{-3} watt cm^{-2} and 15 percent for solar radiation, averaged, allowing for night, weather, and varying angle of incidence; and 3.10^{-4} watt cm^{-2} and 8 percent, for beta radiation from Sr^{90}–Y^{90} of activity 32 Curie/g. However, lattice defects produced by Sr^{90}–Y^{90} beta radiation impair cell performance by increasing electron-hole recombination. A theoretical estimate of threshold energy for radiation damage in silicon is about 0·3 MeV, about half the experimental value reported for germanium. Avoiding radiation damage by annealing, by absorbers, and by use of less energetic isotopes is discussed. The Y^{90} beta spectrum is given; it is used in estimating damage rates in germanium, which are high, and efficiencies obtainable with absorbers, which are low. Theory and experiment are compared for Sr^{90}–Y^{90} cells of silicon and of germanium."

621.311.6 : 621.373.42 **1165**

An R.F. Source of Heater Power for Low-Level Audio-Frequency Amplifiers.—L. Medina. (*Proc. Instn Radio Engrs, Aust.*, Oct 1954, Vol. 15, No. 10, pp. 251–252.) Details are given of a simple and compact oscillator having a rated output of 6·3 V 0·45 A at 400 kc/s.

621.311.6 : 621.373.52 **1166**

A New Self-Excited Square-Wave Transistor Power Oscillator.—Uchrin & Taylor. (See 974.)

621.311.6 : 621.383.5] : 621.396.61 : 621.314.7 **1167**

Transmission by Sun Power Achieved.—(*Short Wave Mag.*, Oct. 1954, Vol. 12, No. 8, pp. 442–446.) Successful communication at 160-m λ over a distance of about 32 miles using a Se-photocell-powered transistor-transmitter is reported. The power unit, consisting of 16 photocells illuminated by sunlight, is described.

621.311.6 : 621.387 **1168**

Stabilized D.C. Supplies using Grid-Controlled Rectifiers.—L. Knight. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 16–19.) Circuits using 'magnitude-controlled' thyratrons are discussed; these are suitable for h.v. power supplies where the load is reasonably constant and the output voltage regulation is not required to be better than within about 1%. A unit incorporating two Type-2D21 miniature thyratrons can supply 200 V at 150 mA.

621.314.67 : 621.387 **1169**

Wide-Range Operation of Grid-Controlled Rectifiers.—D. H. McEwan. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 24–27.) "A method of controlling thyratron conduction over a wide range from a d.c. control signal is described and the steady-state characteristics of a d.c. power amplifier employing this method of control in a bi-phase rectifier circuit are discussed and experimental results given."

621.316.722.1 **1170**

An Alternating-Voltage Stabilizer.—D. J. R. Martin. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 35–37.) A unit designed to give an output of 240 V, varying by $< 0{\cdot}2\%$ for line-voltage changes of $\pm 12\frac{1}{2}\%$, frequency changes of $\pm 4\%$ and load variations from 50 to 150 W, includes provision for correction of form factor by simultaneously stabilizing the rectified-mean and r.m.s. voltages.

621-526 **1171**

A Textbook of Servomechanisms. [Book Review]—J. C. West. Publishers: English Universities Press, 238 pp., 25s. (*P.O. elect. Engrs' J.*, Oct. 1954, Vol. 47, Part 3, p. 158.)

TELEVISION AND PHOTOTELEGRAPHY

621.397.24 : 621.315.212 **1172**

Experimental Television Transmission over the Coaxial Cable between Amsterdam and Haarlem.—L. F. Dert. (*Commun. News*, Aug. 1954, Vol. 15, No. 1, pp. 27–30.) Report of trials carried out during November 1952, using British-made cable Type LC20 with telcothene dielectric, both cable and associated equipment having been designed originally for carrier-current telephony. The 5-Mc/s bandwidth of the 625-line signals had to be reduced to fit the available channel; a carrier frequency of 1 Mc/s was used with a main sideband of width 3·2 Mc/s and a vestigial sideband of width 0·5 Mc/s. A double modulation process was used. The received signal passed through two delay equalizers. Pictures of good quality were obtained.

621.397.241 : 621.397.6 **1173**

"Piped" Scanning Waveforms.—E. J. Gargini. (*Wireless World*, Feb. 1955, Vol. 61, No. 2, pp. 83–87.) Account of a wired television distribution system in which receiver design is simplified by transferring as much circuitry as possible to the transmitter. Two r.f. carriers are transmitted, together with sound signals at speech-coil level. A 5·42-Mc/s wave carries the picture information, and a 1-Mc/s wave carries the scanning signals. Frame-scan and line-scan waveforms are respectively derived by passing the demodulated scanning signals through a low-pass and a high-pass filter. A circuit diagram is given of a 3-valve a.c./d.c. receiver and a block diagram of the waveform generator at the transmitter. Under fault conditions and at the end of a programme transmission a d.c. potential is transmitted to take all receivers out of circuit. Power levels are discussed in relation to field-test results.

621.397.26 : 621.396.65 **1174**

The Milan/Turin Television Radio Link.—F. Vecchiacchi. (*Ricerca sci.*, Oct. 1954, Vol. 24, No. 10, pp. 1978–2007.) This two-way link operates in the 900-Mc/s band with two different carrier frequencies. Horn aerials with parabolic reflectors give a gain > 28 db. There is full visibility along each of the sections Turin/Trivero/Milan/Penice; the section lengths are 75, 87 and 77·5 km respectively. F.m. is used, with unity modulation index. The signal is repeated at the intermediate stations using simple frequency conversion with amplification at about 70 Mc/s.

621.397.5 : 535.623 **1175**

Observer Adaptation Requirements in Color Photography and Color Television.—R. M. Evans & W. L. Brewer. (*J. Soc. Mot. Pict. Telev. Engrs*, July 1954, Vol. 63, No. 1, pp. 5–9. Discussion, p. 9.)

621.397.5 : 535.623 **1176**

Color Balance for Television.—D. L. MacAdam. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 11–14.) Consideration is given to problems introduced by the requirement that colour rendering in the television picture should be independent of the type of illumination used at the transmitter and at the receiver. It is recommended that illumination having a colour temperature of 4 000°K should be used when testing the colour balance of television receivers.

621.397.5 : 535.623 **1177**

Comment on "N.T.S.C. Signal Specifications for Color Television".—W. L. Brewer & J. H. Ladd. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, p. 100.) Comment on 3369 of 1954 (Fink).

621.397.6 **1178**

Television Standards Conversion.—H. A. Fairhurst. (*Wireless World*, Feb. 1955, Vol. 61, No. 2, pp. 53–54.) A brief sketch is given of a theoretically possible direct conversion method in which signal trains corresponding to selected picture lines at higher definition are stretched to the duration of the lower-definition lines. This is performed by feeding the signals to delay lines with capacity sufficient to hold the whole train, and switching the characteristics of the delay line so that the signal train emerges stretched. One possible way of producing a suitable delay line is to wind it on a closed ferrite core which can be saturated magnetically by means of an auxiliary winding.

621.397.6 : 621.372.552 **1179**

Cable Equalization for Television Studio Circuits.—R. C. Kennedy. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 581–601.) Design theory and application procedures are presented for both fixed and variable equalizers.

621.397.611.2 **1180**

The Performance of Television Transmitting Tubes with Stored Charges.—D. D. Aksenov. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1788–1797.) The mechanisms of processes occurring in stored-charge camera tubes, in particular the iconoscope, are discussed in relation to sensitivity limits and distortion of light values in the transmitted image.

621.397.62 **1181**

Practical Aspects of Multichannel and Multistandard Television Receivers.—L. Chrétien & R. Aschen. (*TSF et TV*, Oct. 1954, Vol. 30, No. 312, pp. 314–319.) Synchronization problems and their solution are reviewed.

621.397.62 **1182**

Receiver for Three Standards.—M. Venquier. (*Télévision*, Oct. 1954, No. 47, pp. 251–255.) Modernized version of an earlier design of 625-line-standard receiver (*Télévision*, Feb. 1952, No. 21, p. 45) for receiving Lille and the two Brussels transmissions. Design features are outlined and a circuit diagram is given with component values, coil data and operating voltages.

621.397.62 + 621.396.62] : 061.4 **1183**

26th Swiss Radio and Television Exhibition [August 1954].—(*Bull. schweiz. elektrotech. Ver.*, 2nd Oct. 1954, Vol. 45, No. 20, p. 862.) A brief account is given of the main trends noted in domestic radio and television receiver design.

621.397.62.001.4 **1184**

Measurements on Television Receivers: Part 6—Measurements of Linearity, Sensitivity and Selectivity in the Video and Sound Channels.—O. Macek. (*Arch. tech. Messen*, Oct. 1954, No. 225, pp. 235–238.) Part 5: 567 of February.

621.397.7 **1185**

Monte Carlo Television Station.—C. B. Bovill. (*Wireless World*, Feb. 1955, Vol. 61, No. 2, p. 55.) Aerials of bat-wing type provide a main radiation lobe with a horizontal width of about 45° covering the main Riviera; use is made of very small secondary lobes to cover some nearby towns. The effective radiated power on the vision frequency of 199·7 Mc/s is 50 kW. The 819-line standard is used, the bandwidth being > 10 Mc/s. Modulation signals are conveyed over the two-mile path between studio and transmitter by a duplicated radio link operating at 4 cm λ.

621.397.7 : 621.395.65 **1186**

The Use of Telephone Selector Switches on Television Circuits.—H. D. M. Ellis & J. C. Taylor. (*B.B.C. Quart.*, Autumn 1954, Vol. 9, No. 3, pp. 185–192.) An account is given of equipment used at the B.B.C. Lime Grove studios.

621.397.823 + 621.396.823 **1187**

Ignition Interference at Frequencies below 100 Mc/s: the Mechanism of its Production.—G. F. Newell. (*B.B.C. Quart.*, Autumn 1954, Vol. 9, No. 3, pp. 175–184.) Results of measurements were in good agreement with the interference field-strength spectrum calculated on the assumption that the ignition system acts as a loop aerial in free space carrying a uniform current. Screening of the ignition system was neglected. At all frequencies the radiated interference is proportional to the area enclosed by the ignition leads and the engine-block surface and to the voltage required to break down the sparking-plug and distributor gaps. At frequencies below 20 Mc/s it is proportional to the capacitance across the secondary winding of the ignition coil; above 30 Mc/s it is inversely proportional to the inductance of the ignition leads. The reduction of interference by use of the conventional resistor suppressors was also measured. Results are presented graphically.

TRANSMISSION

621.396.61.029.55 : 621.376.2 : 621.3.018.78 **1188**

Use of Negative Feedback in Independent-Sideband and Double-Sideband Transmitters.—E. Oger. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 329–341.) An analysis of the basic causes of distortion and crosstalk in d.s.b. and independent-sideband transmitters illustrates the importance of avoiding amplitude distortion particularly in the latter case. A negative-feedback arrangement used in 2-kW and 20-kW transmitters is described in which the waveforms at the transmitter output and the final-frequency-changer input are compared, after detection, to derive a correction voltage. The design of a phase-correction network for operation in the range 3·75–28 Mc/s is discussed. Results of measurements on a transmitter with this feedback arrangement show an intermodulation ratio below −40 db up to a peak power of 20 kW for independent-sideband operation, and distortion level below −36 db for A3 operation at 86% modulation.

VALVES AND THERMIONICS

621.314.63 **1189**

Surface Leakage Current in Rectifiers.—M. Cutler & H. M. Bath. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1440–1441.) Theory based on a simple model is developed; the results obtained are supported by experimental observations on several semiconductor types of rectifier.

621.314.63 **1190**

The Variation of the Forward Characteristics of Junction Diodes with Temperature.—J. S. Schaffner & R. F. Shea. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, p. 101.) A typical value for the temperature variation of the forward voltage of a junction diode at constant current is −2 mV/deg.C.

621.314.63 : 546.289 **1191**

Reverse Saturation Current in One Type of *p-n*-Junction Rectifier.—J. Laplume. (*C. R. Acad. Sci., Paris*, 3rd Nov. 1954, Vol. 239, No. 18, pp. 1126–1128.) The type of rectifier considered is that described by Hall (834 of 1953), having donor and acceptor regions fused to opposite faces of a Ge disk. Analysis is presented to show that the contribution of surface recombination to the reverse saturation current is predominant if $2s\tau > R$, where s is the surface recombination velocity, τ the volume lifetime and R the radius of the disk.

621.314.7 **1192**

Effect of Base-Contact Overlap and Parasitic Capacities on Small-Signal Parameters of Junction Transistors.—R. L. Pritchard. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 38–40.) "In a grown-junction transistor in which the base connection consists of an alloy contact, overlap on emitter and/or collector regions may produce appreciable capacity between emitter-base and collector-base terminals. The effect of such overlap capacity upon measured small-signal parameters at high frequencies is described briefly for both grounded-base and grounded-emitter operation."

621.314.7 **1193**

Study of *P-N-P* Alloy Junction Transistor from D.C. through Medium Frequencies.—L. J. Giacoletto. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 506–562.) The theoretical development of design equations for alloy-junction transistors is considered. Grown-junction-transistor theory [379 of 1950 (Shockley) and 3177 of 1951 (Shockley et al.)] is found to be applicable as long as the current density does not exceed a certain value. Base-lead resistance and collector shunt conductance are discussed. Measurements are reported on a transistor of the type described by Law et al. (876 of 1953); the results are in reasonably good agreement with those obtained from the theory.

621.314.7 : 537.311.33 **1194**

The Influence of Surface Recombination on the Current Gain of the Junction Transistor.—J. Laplume. (*C. R. Acad. Sci., Paris*, 15th Nov. 1954, Vol. 239, No. 20, pp. 1274–1276.) Analysis similar to that previously presented for a junction diode (1191 above) is developed for the transistor, assuming a model with a disk base of radius R, surface recombination velocity s and volume lifetime τ. Formulae are derived from diffusion considerations for emitter and collector current and hence for the gain. The results indicate that surface recombination is again predominant when $2s\tau > R$. The theory can be readily extended to apply to steady-state a.c. conditions.

621.314.7 : 546.28 **1195**

Forming Point-Contact Silicon Transistors.—H. Jacobs, F. A. Brand, W. Matthei & A. P. Ramsa. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1406–1412.) Performance tests are reported on transistors with impurities introduced locally by the arcing technique previously described [1246 and 1607 of 1954 (Jacobs et al.)]. Voltage gains up to 75 and power gains between 15 and 60 are reported. Curves are shown of the variation of current gain with emitter current for various Si specimens. The current multiplication mechanism is discussed in the light of theory developed by Sittner (2366 of 1952).

621.314.7.001.4 **1196**

Testing Point-Contact Transistors for Pulse Applications.—Wooley. (See 1092.)

621.314.7.012 **1197**

Small-Signal Parameters for Transistors.—R. L. Pritchard. (*Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, pp. 902–905.) "The commonly used sets of parameters are discussed briefly and it is shown how the performance of the transistor can be determined with equal facility from any of the sets that may be provided."

621.385 **1198**

Practical Considerations in the Design of Low-Microphonic Tubes.—T. M. Cunningham. (*RCA Rev.*, Dec. 1954, Vol. 15, No. 4, pp. 563–580.) "A definition of microphonism is given, and the modes of electrode movement which cause microphonic action are described. Various design methods used in the production of commercial receiving-type tubes to reduce microphonism are evaluated. In some cases, modification of existing designs to reduce the microphonic parasitic effect proves impractical because of other considerations."

621.385.029.6 **1199**

Valves for Input and Output Stages in the 4-kMc/s Band.—H. Rothe. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 532–539.) A comparison of the suitability of grid-controlled valves, travelling-wave valves and klystrons. Noise characteristics and power-handling capacity are considered.

621.386.029.6 **1200**

The Potentials in the Magnetron—Consequences in Design.—K. Fritz. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 528–531.) Energy relations are derived for the electrons; the form of the optimum electron path points to the desirability of segment arrangements other than circularly symmetrical. The magnetron mechanism is elucidated by analogy with an acoustic delay line. Special-purpose magnetrons designed in accordance with the theory are illustrated.

621.385.029.6 **1201**

Effect of Velocity Distribution on Traveling-Wave Tube Gain.—D. A. Watkins & N. Rynn. (*J. appl. Phys.*, Nov. 1954, Vol. 25, No. 11, pp. 1375–1379.) Application of theory developed previously [3289 of 1952 (Watkins)]. For a typical travelling-wave valve the thermal velocity distribution reduces the gain by < 1 in 10^4. For a valve using magnetic focusing and a high-perveance beam the velocity spread resulting from space charge lowers the gain by about 1%.

621.385.029.6 **1202**

Beam Focusing by Periodic and Complementary Fields.—K. K. N. Chang. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 62–71.) Theory of beam focusing in travelling-wave valves by means of space-periodic magnetic or electrostatic fields is surveyed. An alternative method of focusing is proposed using complementary magnetic and electrostatic fields which need not necessarily be space-periodic; stable beams free from scalloping can be produced. The system is particularly useful for focusing in the accelerating region of the gun.

621.385.029.6 : 621.372.2 **1203**

Delay Lines with Periodic Structure in Travelling-Wave Valves.—W. Kleen. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 547–553.) See also 2375 of 1952 (Kleen & Ruppel).

621.385.029.6 : 621.372.2 **1204**

Investigation of Lines with Periodic Bar Structure: Part 2.—A. Leblond & G. Mourier. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 311–328.) Theory developed in part 1 (3087 of 1954) is applied to the design of wide-band systems. The dispersion characteristics for certain comb-type and interdigital-type structures are determined. Study of the shape of the dispersion curve near the cut-off points illustrates the validity of the general expression for characteristic impedance. The physical significance of the 'transverse-field' theory and its range of validity are discussed. The matching of an interdigital walled type of line to a coaxial system is treated by a method analogous to that used for determining the resonance frequencies of the interdigital magnetron (part 1). This method can be adapted for any type of bar structure.

621.385.029.63/.64 **1205**

Reflex Klystron for Grid Pulse Operation within the Frequency Range 2 000–5 000 Mc/s.—L. Torstensson. (*Ericsson Tech.*, 1954, Vol. 10, No. 2, pp. 297–308.) The klystron described is designed to give an output of 1 W for pulsed operation and 100 mW for c.w. operation as a local oscillator; a spherical control grid in front of the cathode is used for the pulsed operation only. The external cavity has plunger tuning. Calculated values of output power as a function of frequency are compared with observed values.

621.385.029.63 **1206**

Low-Noise Travelling-Wave Valves.—H. Schnitger & D. Weber. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 540–546.) A design using only one pre-anode is described, with which a noise figure as low as 10·3 db can be achieved in conjunction with a gain of 27 db, operating at a wavelength of 16 cm, with 290 V on the helix and 95 V on the pre-anode and a magnetic focusing field of only 200 G. The importance of such simple designs for use at radio-link relay stations is indicated.

621.385.029.64 **1207**

The TL6, a Telefunken Travelling-Wave Valve for the Frequency Range around 4 000 Mc/s.—(*Telefunken Ztg*, Sept. 1954, Vol. 27, No. 105, p. 187.) Designed for the output-amplifier stage of a dm-λ transmitter. The helix is held firmly in position by three ceramic rods fitting into two metallic caps.

621.385.029.64 **1208**

Theory of the Carcinotron.—K. Pöschl. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 558–561.) The starting current of the carcinotron oscillator is calculated on the basis of the linear theory of travelling-wave valves, using appropriate boundary conditions.

621.385.029.64 **1209**

The Carcinotron, an Electrically Tuned Microwave Generator.—W. Veith. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 554–558.) The mechanism of production of the backward wave is explained. A valve is described in which a hollow beam is produced surrounding the helix and focused by a longitudinal magnetic field of strength 800 G. This construction enables the helix to be wound very uniformly and permits a gradual wide-band transition to a coaxial line at the cathode end. An external aquadag layer is provided at the collector end to attenuate unwanted waves. A helix with high coupling and relatively small tuning range was used in preference to one with low coupling and large range, to ease the requirements in relation to constancy of voltage and to provide greater power. Measurements of performance at 4 kMc/s are reported.

621.385.029.64 : 621.376.32 **1210**

Modulation Properties of the Reflex [klystron] **Generator.**—J. Labus. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 562–565.) Simple analysis indicates that good linearity of the frequency-modulation characteristic is achieved by suitably loading the klystron resonator. The distortion depends on the signal frequency shift and on the resonator Q but is practically independent of the oscillation mode. The frequency shift corresponding to half power and the maximum power reach their peak values at about the same value of the resonator Q. The slope of the modulation characteristic depends on the oscillation mode and on the Q. Experimental results are reported.

621.385.029.65 **1211**

Helix Millimeter-Wave Tube.—W. V. Christensen & D. A. Watkins. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 93–96.) Development work on backward-wave oscillators with tape helices is reported. A valve is described in which a tungsten helix of length 1 in., internal diameter 0·025 in., and tape cross-section 0·002 in. by 0·005 in. is supported on quartz knife-edges so as to be able to dissipate its heat by direct conduction to the outside of the all-glass envelope. The output is taken by means of a helix-to-waveguide transition inside the envelope; this waveguide meets the glass wall at an angle and is continued by a further waveguide section outside the envelope. The c.w. power is $>$ 1 mW over the frequency range 50–67 kMc/s. Tuning is accomplished by varying the helix potential, which is 1 680 V at 5 mm λ.

621.385.029.65 **1212**

Traveling-Wave Tube Experiments at Millimeter Wavelengths with a New, Easily Built, Space Harmonic Circuit.—A. Karp. (*Proc. Inst. Radio*

Engrs, Jan. 1955, Vol. 43, No. 1, pp. 41–46.) Delay structures comprising ridged waveguides with transverse slots are discussed. For the small sizes necessary for operation at millimetre wavelengths the slotted structure is formed either by winding a grid or by photo-etching a thin metal sheet. The electron beam may flow on either or both sides of the slotted wall. Experiments with amplifier valves and backward-wave oscillators are described. A spacing of about 55 slots/in. was used for amplification at 5 mm λ, with a 1-kV beam. The ratio of slot width to pitch passed through an optimum value between 0·3 and 0·5. A structure for a backward-wave oscillator was made by winding Au-coated Mo ribbon 0·001 in. thick and 0·0055 in. wide at 92 turns/in. on a Cu-plated Mo body. This valve was tunable from 57 to 61 kMc/s by varying the beam voltage from about 900 to 1170 V.

621.385.032.21 : 621.3.018.75 : 537.581 **1213**

The Velocity Distribution of Electrons of Thermionic Emitters under Pulsed Operation: Part 2—Experimental Results and a Tentative Theoretical Explanation.—C. G. J. Jansen, R. Loosjes & K. Compaan. (*Philips Res. Rep.*, Aug. 1954, Vol. 9, No. 4, pp. 241–258.) The velocity distribution of electrons emitted from cathodes with (BaSr)O and SrO coatings under square-pulse conditions shows a large dispersion, the spectra consisting of fairly discrete lines which gradually contract to a single line as d.c. is added. Coatings of BaO, ThO_2, and a mixture of (BaSr)O and Ni powder give a one-line spectrum, less sharp than that obtained with metallic cathodes. A detailed discussion is given of possible mechanisms accounting for these results. Part 1: 2837 of 1953 (Jansen & Loosjes).

621.385.032.213 **1214**

Modern Thermionic Cathodes.—N. D. Morgulis. (*Uspekhi fiz. Nauk*, Aug. 1954, Vol. 53, No. 4, pp. 501–543.) A survey. Metallic cathodes are considered under (*a*) pure metal cathodes, and (*b*) metallic cathodes covered with monatomic films: non-metallic cathode materials are grouped into (*a*) oxides of alkaline-earth metals, (*b*) chemical compounds of metals, and (*c*) mixed metal-ceramic systems. The properties are discussed mainly from the experimental point of view and theory is presented only briefly. Over 70 references.

621.385.032.216 **1215**

Spectral Dependence of Thermionic Emission with Activation from (Ba-Sr)O Cathodes over 0·6–3·5 eV Region.—T. Hibi & K. Ishikawa. (*Phys. Rev.*, 1st Sept. 1954, Vol. 95, No. 5, pp. 1183–1184.) Variation of the spectral dependence with activation observed previously (284 of 1953) is confirmed by more precise measurements using a monochromator.

621.385.032.216 **1216**

International Congress to mark the Fiftieth Anniversary of the Oxide Cathode.—(*Le Vide*, May & July/Sept. 1954, Vol. 9, Nos. 51 & 52/53, pp. 3–93 & 100–211.) The text is given of the following papers presented at the congress:—

Wehnelt's Discovery. Evolution of Ideas on the Thermionic Emission Mechanism of Oxide Cathodes (pp. 8–12).—R. Warnecke.

The Work of the American Society for Testing Materials on Specifications and Standards for Oxide Cathodes (pp. 13–16).—A. M. Bounds & T. H. Briggs. English version included.

Wehnelt and his Work (p. 17).—C. Biguenet.

Development of New Cathode Nickels with Improved Performance (pp. 18–21).—A. M. Bounds, T. H. Briggs & C. D. Richard. English version included.

Nickel in the Manufacture of Oxide Cathodes (pp. 22–27).—J. Challansonnet.

Experimental Results on the Behaviour of Cathode Nickel heated in Vacuum (pp. 28–32).—J. Richard.

Some Metallurgical Aspects of Nickel for Thermionic Cathodes (pp. 33–41).—Nguyen Thien-Chi.

Premature Breaking of Very Thin Nickel Filaments with Additions of Aluminium and Magnesium as a result of Rapid Recrystallization with Grain Slipping (p. 42).—L. Piatti.

Conditions for Precipitation of Carbonates and Crystal Structure (pp. 43–55).—K. Amakasu, M. Fukase, E. Sekine, M. Takahashi, H. Noaki & S. Hirota. English version included.

Dosage of Sodium in Alkaline-Earth Carbonates by γ Rays from Sodium 24 (pp. 56–57).—R. Gobin.

The Influence of the Physical and Chemical Properties of the Coating on the Emission from the Oxide Cathode (pp. 58–69).—D. A. Wright. English version included.

Results on the Emission from a Single Isotope (pp. 70–71).—M. Berthaud.

Nitrocellulose as Binder in the Manufacture of Oxide Cathodes (pp. 72–74).—Lhoste.

Production of Smooth Oxide-Cathode Surface by Spraying, and Measurement of the Roughness (pp. 75–80).—Y. Nakamura, S. Okada & Y. Kato.

Problems encountered in the Spray-Coating of Oxide Cathodes (pp. 81–89).—J. Schweitzer.

A Simple Method of determining the Degree of Thermal Decomposition of Barium Carbonate in Vacuum (pp. 90–93).—K. M. Yazawa.

The Nature of the Donors inside the Oxide Layers. Calculation of their Energy of Dissociation (pp. 100–105).—J. Ortusi.

Use of the Radioactive Isotope for studying the Evolution of Strontium from Strontium Oxide under Electron Bombardment (pp.106–108).—S. Yoshida, N. Shibata, Y. Igarashi & H. Arata. English version included.

Photoconductivity of BaO (pp. 109–112).—M. Sakamato. English version included.

Study of Cathodoluminescence of (Ba, Sr)O (pp. 113–115).—K. Noga & K. Nakamura. English version included.

The Effect of Positive-Ion Bombardment on Oxide Cathodes (pp. 116–120).—K. Takeya, T. Shirakawa & S. Takahashi. English version included.

The Effects of Barium and Oxygen Vapours on the Spectral Dependence of Thermionic Emission from (Ba, Sr)O Cathodes (pp. 121–124).—Hibi & Ishikawa. English version included.

Migration of Impurities at the Nickel/Oxide Interface of Oxide Cathodes (pp. 125–128).—G. A. Giger.

Abnormal Velocity Distribution of Electrons emitted by Pulsed Oxide Cathode (pp. 129–134).—C. G. J. Jansen, R. Loosjes & K. Compaan.

Oscillographic Method for determining Work Function as a Function of Temperature (pp. 135–138).—C. G. J. Jansen, R. Loosjes, J. J. Zaalberg van Zelst & G. A. Elings.

Measurement of Cathode Properties using Long Pulses (pp. 139–147).—P. Sevin & M. Berthaud.

Measurements of Transverse Resistance of Oxide Cathodes (pp. 148–154).—A. Kestelyn-Loebenstein.

On the Conductivity of Oxide Cathode Coatings (pp. 155–160).—T. B. Tomlinson. English version included.

Behaviour of Cathode Parasitic Impedance as a Function of Time and of Conditions of Use (pp. 161–165).—P. Sainte-Beuve.

Development of Parasitic Impedance in Oxide Cathodes (pp. 166–170).—A. Lieb. German version included.

Experiments bearing on the Mobile-Donor Hypothesis in Oxide Cathodes (pp. 171–176).—L. S. Nergaard. English version included.

Films of Electron Micrographs of Hot Cathodes (pp. 177–180).—E. Brüche. German version included.

Investigation of Oxide Cathodes by Analysis of Electron Velocities in a Special Valve (pp. 181–187).—O. Pfetscher & W. Veith. German version included.

Cathode-Characteristic Tracer (pp. 188–190).—R. Echard.

On the Relations between Electron Emission, Conduction and Noise of Oxide-Coated Cathodes (pp. 191–199).—J. Nakay, Y. Inuishi & Tsung-Che. English version included.

Background Noise of Oxide Cathodes (pp. 200–202).—J. Dalbert.

Flicker Effect at Microwave Frequencies (pp. 203–205).—M. Musson-Genon.

Low-Frequency Fluctuations in the Conductivity of the Oxide-Coated Cathode (pp. 206–211).—T. B. Tomlinson. English version included.

For a shortened version, in German, of Warnecke's introductory paper, see *Elektrotech. Z., Edn A*, 11th Oct. 1954, Vol. 75, No. 20, pp. 677–680.

621.385.032.216 : 533.583 **1217**

Application of a Tracer to Cathode-Gettering and Gas-Adsorption Problems.—F. de Boer & W. F. Niklas. (*Brit. J. appl. Phys.*, Sept. 1954, Vol. 5, No. 9, pp. 341–342.) The gettering effect of the heated oxide cathode in a c.r. tube of small volume was investigated by radioactivity measurements after introduction of the ^{14}C isotope. Results indicate that the cathode oxide layer has a specific gettering power about 500 times that of the stainless-steel gun components.

621.385.032.216 : 621.317.733 **1218**

A Bridge for the Measurement of Cathode Impedance.—Matheson & Nergaard. (See 1109.)

621.385.2 **1219**

Effect of Filament Voltage on the Plate Current of a Diode.—H. S. C. Chen. (*J. appl. Phys.*, Oct. 1954, Vol. 25, No. 10, p. 1345.) Correction to paper noted in 3730 of 1954.

621.385.3 **1220**

Triodes with Very Small Electrode Spacings.—F. W. Gundlach. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 516–521.) The variation of the input conductance and noise factor of u.h.f. disk-seal valves due to the reflection of electrons from the space-charge potential minimum is shown by approximate calculations for the two limiting cases, (*a*) very large grid-cathode spacing, such that the potential minimum can be treated as a virtual cathode, and (*b*) very small spacing, such that no potential minimum occurs. The usual spacing in present-day valves, about 10 μ, is between these two extremes, and the development of theory for this intermediate case is required.

621.385.3 **1221**

The Input Admittance of Triodes.—W. Dahlke. (*Fernmeldetech. Z.*, Oct. 1954, Vol. 7, No. 10, pp. 522–528.) In ordinary non-ideal triodes the penetration of the anode field through the grid is nonuniform; as the grid potential is made more negative the emission from the cathode is suppressed first at regions where the penetration is least. The input admittance is here calculated by summing the effects due to all the emitting regions; a new parameter called the 'relative dispersion of the penetration factor' is introduced. Results of measurements indicate that this method of analysis explains previous discrepancies between observations and theory.

621.385.3.012 **1222**

Static Characteristics of Non-ideal Triodes.—W. Dahlke. (*Telefunken Ztg*, Sept. 1954, Vol. 27, No. 105, pp. 172–186.) The effect on the static characteristics of a valve with negative grid bias of fluctuations in penetration factor due to irregularities in the grid structure is considered, the approach being on the same lines as in earlier work (e.g. 2085 of 1952). The characteristics are computed and displayed in tables and graphs for various statistical distributions of the penetration-factor fluctuations. In general they are dependent only on perveance, and on the statistical mean and relative dispersion values of the penetration factor. The determination of these three factors by computation and by experiment is discussed and illustrated by examples. Agreement between the two methods is satisfactory, but could be improved if initial electron velocities were taken into account. See also 1221 above.

621.385.3.029.63/.64 **1223**

A Triode Useful to 10 000 Mc/s.—J. E. Beggs & N. T. Lavoo. (*Proc. Inst. Radio Engrs*, Jan. 1955, Vol. 43, No. 1, pp. 15–19.) Valves of very small size can be manufactured using low-loss quartz or ceramic insulating parts soft-soldered to copper parts during a high-temperature exhaust process. A description is given of the Type-L29 receiving valve, which is suitable for use in either distributed or lumped-constant circuits. It has a noise figure of 7 db at 1·2 kMc/s and is capable of giving an output of 40 mW at 10 kMc/s. A smaller version, Type L-31, and a commercial version, Type GL6299, are also mentioned.

621.385.3.029.63 **1224**

U.H.F. Triodes.—W. J. Pohl & D. C. Rogers. (*Wireless Engr*, Feb. 1955, Vol. 32, No. 2, pp. 47–52.) "The relationships between earthed-grid class C triode performance and electrode dimensions are outlined and combined with the factors concerning the safe operation of the grid. This leads to a simple design procedure which enables the rapid determination of the main electrode dimensions to satisfy given circuit requirements. The method is applicable to cases in which the maximum permissible grid dissipation can be estimated in terms of the grid dimensions. It applies particularly to disk-seal triodes in which at least one end of each grid wire is in intimate thermal contact with some well-cooled connector external to the valve, which enables a fairly accurate prediction of grid-wire-temperature distribution to be made."

621.385.5.012.3 **1225**

The Use of Screen-to-Plate Transconductance in Multigrid Tube Circuit Design.—K. A. Pullen, Jr. (*Elect. Engng, N.Y.*, Oct. 1954, Vol. 73, No. 10, pp. 876–879.)

621.385.832 + 621.383 **1226**

Electron Lens Raster Systems and their Application in Electron Image Storage Tubes.—M. Knoll. (*Z. angew. Phys.*, Oct. 1954, Vol. 6, No. 10, pp. 442–449.) Theory is presented of a system comprising a two-dimensional array of minute, identical e.s. lenses, and the application of the system in a direct-vision storage tube is described. For a similar report, in English, see Proceedings of the N.B.S. Semicentennial Symposium on Electron Physics, 5th–7th Nov. 1951, *N.B.S. Circular*, No. 527, 17th March 1954, pp. 329–336 and *ibid.*, pp. 339–342 (Knoll & Rudnick). Discussion on both papers, *ibid.*, pp. 343–344.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 **1227**

Air-to-Ground Sound Propagation.—P. H. Parkin & W. E. Scholes. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1021–1023.) "The attenuation of sound in air, in the vertical direction, has been measured on six occasions using an aircraft flying at various heights over a microphone at ground level. It was found that there was always negligible attenuation at frequencies below 1 000 c/s even though the air was turbulent; at higher frequencies the attenuation was found to be of the same order as the Knudsen-Kneser results for attenuation due to molecular absorption."

534.2-8 **1228**

Absorption of Finite-Amplitude Sound Waves.—F. E. Fox & W. A. Wallace. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 994–1006.) Measurements indicate that the absorption coefficient of CCl_4 and water for ultrasonic waves increases with increasing intensity; the effect is attributed to waveform distortion. Theory is presented in which the medium is treated as the acoustic analogue of a transmission line with nonlinear elements.

534.23 + 621.396.67 **1229**

Maximum Directivity Index of a Linear Point Array.—R. L. Pritchard. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1034–1039.) The maximum directivity index of an array is computed as a function of number and spacing of elements. For spacings $< \lambda/2$ a significant improvement of both directivity index and major lobe width may be achieved by departing from uniform excitation. Numerical results are presented for three-, five- and seven-element arrays.

534.24-8 **1230**

Reflection of Sound by Thin Plates in Water.—L. M. Lyamshev. (*C. R. Acad. Sci. U.R.S.S.*, 11th Dec. 1954, Vol. 99, No. 5, pp. 719–721. In Russian.) The nonspecular reflection of sound from brass and aluminium plates immersed in water was investigated experimentally using waves of frequency 1 Mc/s in pulses of duration 30 μs and repetition rate 50/sec. Reflection at angles related to the velocity of propagation of longitudinal waves in the plates was observed, in addition to that related to flexural waves [611 of 1949 (Finney)]. In a 0·8-mm-thick Al plate the respective angles were 16° and 43°, in a 0·58-mm brass plate the reflection maxima due to longitudinal waves occurred at 23°, those due to flexural waves at 66° and 74°; in a 0·38-mm brass plate, where the velocity of flexural waves is lower than the velocity of sound in water, only the maximum due to longitudinal waves was observed, at 23°. Experimental results are presented graphically.

534.26 + [535.42 : 538.566 **1231**

Diffraction of Pulses by a Circular Cylinder.—F. G. Friedlander. (*Commun. pure appl. Math.*, Nov. 1954, Vol. 7, No. 4, pp. 705–732.) Analysis for a sound-pressure field is presented for the two-dimensional case, i.e., uniformity in the direction parallel to the cylinder axis is assumed. The incident, reflected and diffracted fronts are shown diagrammatically. The interpretation of the problem in e.m. terms is indicated.

534.3/.4 **1232**

The Transient Tones of Wind Instruments.—E. G. Richardson. (*J acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 960–962.) "Oscillograph records of the initiation of sound in organ pipes and orchestral wind instruments show large variations from one instrument to another. The causes of these variations and their artistic effects are discussed."

534.6 : 621.395.61 **1233**

Microphone Measurements in a Reverberation Chamber.—L. Keidel. (*Arch. tech. Messen*, Nov. 1954, No. 226, pp. 249–252.) Experiments are described which indicate that reverberation-chamber measurements can be substituted for anechoic-chamber measurements without introducing large errors. Suitable methods are outlined for determining microphone characteristics by comparison with a known microphone. Since the ratio of the sound pressure at the two microphones is measured, it is not necessary to maintain the sound level constant.

534.614 : 621.3.018.75 **1234**

Electronic Pulse Method for measuring the Velocity of Sound in Liquids and Solids.—N. P. Cedrone & D. R. Curran. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 963–966.)

534.75 **1235**

Cumulative Effects of Repeated Bursts of White Noise on Threshold for 4 000-c/s Tone Pips.—C. Lightfoot & J. F. Jerger. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1048–1052.)

534.75 **1236**

Masking of Speech by Repeated Bursts of Noise.—I. Pollack. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1053–1055.)

534.75 **1237**

Intensity Discrimination Thresholds under Several Psychophysical Procedures.—I. Pollack. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1056–1059.) "Discrimination thresholds for the detection of a change in the sound level of a tone were obtained under five experimental procedures."

534.75 **1238**

Method of Reproduction and the Identification of Elementary Auditory Displays.—I. Pollack. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1060–1063.) "A psychophysical procedure which combines the salient features of the classical discrimination and identification experiments is described."

534.76 : 534.86 **1239**

Effect of Arrival Time on Stereophonic Localization.—W. B. Snow. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1071–1074.) Summarized report of experimental work previously published in U.S. Patent No. 2137032.

534.861 **1240**

Radio Studios.—W. Furrer. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Nov. 1954, Vol. 32, No. 11, pp. 430–436. In German.) A brief review of the requirements as regards electroacoustic equipment and acoustic characteristics, with illustrations of studio details.

621.395.623.5 **1241**

Experimental Investigation of Wedge Horns used with Line Hydrophones.—C. M. McKinney & C. D. Anderson. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1040–1047.) Radiation patterns are presented for horns constructed of Al plates covered with cellular rubber set at angles up to 90°. The frequency range investigated is 60–150 kc/s.

621.395.623.5 **1242**

Acoustical Studies of the Tractrix Horn: Part 1.—R. F. Lambert. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1024–1028.) By assuming the constant-phase surfaces in the horn flare to be spheres, and the flow lines to be tractrices, a one-parameter wave equation and Ricatti impedance equation are derived. Comparison of measured values of axial response and throat impedance with calculations based on a hemispherical and on a plane piston indicate that the actual configuration is intermediate between these two.

621.395.623.5 **1243**

Acoustical Studies of the Tractrix Horn: Part 2.—A. O. Jensen & R. F. Lambert. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 1029–1033.) Measurements of the free-field radiation characteristics are reported. Small and large baffle mountings were investigated. Results for two-cell units indicate a performance comparable with that of the exponential horn. Multicellular structures give improved uniformity of angular distribution at high frequencies, but exhibit undesirable band-rejection characteristics within the useful frequency range. Part 1 : 1242 above.

621.395.625.6 **1244**

An Optical Method for Reducing the Noise inherent in Sound Films.—V. S. Man'kovski. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 2025–2035.) A complex electrical device is normally used in sound recording for varying the average density of the film with the modulation level. The same result can be achieved with the aid of a simple optical system in the light modulator, based essentially on the use of an additional wide slot. The theory of the method is discussed in detail and results are given of experiments indicating that the reduction of noise so obtained is equivalent to that given by the electrical method (10 db).

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.397 **1245**

Progress in the Statistical Treatment of Characteristic-Impedance Irregularities in Television Cables.—H. Kaden. (*Arch. elekt. Übertragung*, Nov. 1954, Vol. 8, No. 11, pp. 523–529.) Formulae obtained previously for the far-end effect (2070 of 1953) were based on the assumption of an exponential autocorrelation function for the cable irregularities. The theory is now generalized to apply to an arbitrary autocorrelation function, and the special case of a Gaussian error function is examined. Permissible values of irregularity are tabulated for wide-band and for feeder cable. For the latter type the outer conductor should be of such design that the correlation range is > 1 m, in which case the requirements as regards uniformity are not too stringent. The reflection coefficient at the aerial should be < 1·6%. A r.m.s. value of 1% is assumed for the far-end effect in the tables.

621.315.212.1 : 621.315.682 **1246**

Coaxial Plug Connectors for Communication Engineering.—H. Larsen & F. Haas. (*Frequenz*, Sept. 1954, Vol. 8, No. 9, pp. 267–276.) The construction of connectors for use at frequencies up to 3 kMc/s is described and discussed. The particular problem of connecting 60-Ω to 75-Ω lines is also discussed and calculations show that reflection can be neglected when using the 6/16-mm (internal/external diameters respectively) cable connectors. The characteristics of the 2·5/6·5-mm and the 11/30-mm standard connectors are also given.

621.372.2 **1247**

Electromagnetic Wave Propagation on Helical Structures (a Review and Survey of Recent Progress).—S. Sensiper. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 149–161.) Includes 58 references.

621.372.2 **1248**

Electromagnetic Processes in a Multiconductor System.—P. I. Kuznetsov & R. L. Stratonovich. (*Bull. Acad. Sci. U.R.S.S., tech. Sci.*, Sept. 1954, No. 9, pp. 3–23. In Russian.) The e.m. field in a multiconductor system is determined by using Maxwell's equations with boundary conditions given by a set of inequalities relating the electric and magnetic constants of the conductor and the surrounding space. The impedance and admittance matrices of the telegraphy equation are derived and the conditions for the equivalence of Maxwell's and Kirchhoff's equations are deduced. The theory is applied to the case of a two-conductor system parallel to a plane ideally conducting surface, and simplification is obtained by putting $a \ll l$, where a is the radius of the conductors and l is their separation or distance from the surface; the error introduced by this simplification is of the order of $(a/l)^2$. The interaction of signals transmitted along two parallel conductors is also briefly considered.

621.372.2 : 621.315.212 **1249**

Coaxial Line with Helical Inner Conductor.—W. Sichak. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, p. 148.) Correction to paper abstracted in 3123 of 1954.

621.372.43 **1250**

Theory and Design of Wide-Band Multisection Quarter-Wave Transformers.—R. E. Collin. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 179–185.) "A general theory of the n-section quarter-wave transformer is presented. It is shown that optimum bandwidth with a minimum pass band tolerance is obtained when the power loss ratio is chosen to give Tchebycheff behavior in the pass band. A comparison is made of the Tchebycheff transformer and the maximally flat transformer, and shows that the former gives a large increase in bandwidth—e.g., up to 44 per cent for a 2-section transformer and up to 75 per cent for a 4-section transformer. Design formulas are given for the 2, 3 and 4-section transformers."

621.372.8 **1251**

Propagation Constant in Rectangular Wave Guide of Finite Conductivity.—D. M. Kerns & R. W. Hedberg. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1550–1551.) A formula is presented which holds for frequencies both above and below cut-off.

621.372.8 **1252**

H-Plane Bifurcation of Rectangular Waveguides.—R. A. Hurd & H. Gruenberg. (*Canad. J. Phys.*, Nov. 1954, Vol. 32, No. 11, pp. 694–701.) "Using a method based on the calculus of residues, a rigorous solution has been obtained for the problem of the bifurcation of a rectangular waveguide. Expressions are given for the amplitudes of all the reflected and transmitted modes in the guide. A comparison is made with results obtained by the transform method of Wiener and Hopf."

621.372.8 **1253**

Propagation in Curved and Twisted Waveguides of Rectangular Cross-Section.—L. Lewin. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 75–80.) The problem is investigated by putting the wave equation in a form in which the coordinates in a waveguide cross-section are also the independent variables in the differential equation. The wavelength is found for the E-curved and H-curved guides, and for twisted guides. In the latter case there is a degeneracy when the guide sides become equal. Curves are presented for the correction to the wavelength in a straight guide caused by the bending or twisting.

621.372.8 **1254**

Waveguide Phase Changer.—R. E. Collin. (*Wireless Engr*, March 1955, Vol. 32, No. 3, pp. 82–88.) Various known types of phase changer are surveyed briefly and a description is given of a new type in which the phase shift is produced by longitudinal displacement of a central dielectric strip in a rectangular waveguide with fixed side dielectric strips. Over the wavelength range 3–3·5 cm, the departure from linearity is $< 1^\circ$ and the s.w.r. is $< 1{\cdot}05$.

621.372.8 : 621.317.7 **1255**

Waveguides and Waveguide Junctions.—J. M. C. Dukes. (*Wireless Engr*, March 1955, Vol. 32, No. 3, pp. 65–72.) Problems relating to microwave measurements made through mismatched junctions are considered. The analysis is performed using simple plane geometry, the junction being shown to constitute a bilinear transformation. The required measurement and calculation procedure is detailed. See also various papers by Deschamps (e.g., 14 of 1954).

621.372.8 : 621.318.134 **1256**

Analogy of Ferrite in Waveguide.—G. F. Nicholson. (*Wireless Engr*, March 1955, Vol. 32, No. 3, p. 89.) Asymmetrical attenuation produced by a ferrite rod in a waveguide with a steady transverse magnetic field is explained by using as a model a gyroscope suspended at its centre of gravity.

621.372.8.012.3 **1257**

Nomographs for Rectangular Waveguides.—T. S. Chen. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 172–176, 178.)

621.396.67 + 534.23 **1258**

Maximum Directivity Index of a Linear Point Array.—Pritchard. (See 1229.)

621.396.677.71 **1259**

The Slot Aerial.—B. L. Morley. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 129–131.) Slot aerials have been found effective for eliminating ghost-reception in television. Simple theory and design details are given. The cavity resonator and skeleton slot are mentioned as special cases.

621.396.677.71 **1260**

Radiation from a Slot on a Cylindrically Tipped Wedge.—J. R. Wait & S. Kahana. (*Canad. J. Phys.*, Nov. 1954, Vol. 32, No. 11, pp. 714–721.) The system considered is an infinite wedge with the edge replaced by a portion of a concave cylinder with an arbitrary slot; it constitutes an idealized case of the winged-slot arrangement discussed by Alford (3034 of 1947). Radiation patterns are calculated for thin transverse $\lambda/2$ slots in the equatorial plane, for wedge angles of 90°, 180° and 270°.

621.396.677.85 : 621.372.22 : 537.226 **1261**

Some Experiments on Artificial Dielectrics at Centimetre Wavelengths.—M. M. Z. El-Kharadly. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 17–25.) A parallel-plate transmission line is found to be a convenient system for investigating artificial dielectrics. For the wavelength range 8–11 cm the width of the plates is about 60 cm and the spacing between them about 3 cm to ensure that only the TEM mode propagates. Details are given of the line construction. The method was shown to be accurate to within about 2% by making measurements on ordinary dielectrics. Results of refractive-index and impedance measurements are presented for arrays of spheres, disks and rods. Dispersion is related to (*a*) resonance of the array elements and (*b*) spacing between elements.

621.396.677.85 : 621.372.22 : 537.226 **1262**

A General Experimental Method to determine the Properties of Artificial Media at Centimetre Wavelengths, applied to an Array of Parallel Metallic Plates.—R. I. Primich. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 26–36.) Measurements of refractive index and magnitude and phase of reflection coefficient were made on an artificial dielectric comprising a semi-infinite array of thin metal plates, using a parallel-plate transmission-line system as described by El-Kharadly (1261 above). Use of the parallel-plate system permits precise location of the interface between the artificial dielectric and free space. Satisfactory accuracy is obtained at wavelengths between 9 and 10 cm.

621.396.677.85 **1263**

Modified Luneberg Lens.—A. S. Gutman. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, p. 1553.) Correction to paper abstracted in 3472 of 1954.

621.396.67.012.12 **1264**

Antenna Diagrams. [Book Notice]—International Radio Consultative Committee (C.C.I.R.). Publishers: International Telecommunication Union, Geneva, 52 pp., S.Fr. 18.45. (*Wireless Engr*, March 1955, Vol. 32, No. 3, p. 90.) Contains formulae and power-distribution diagrams for vertical, horizontal dipole, curtain and rhombic aerials and aerials for tropical broadcasting.

AUTOMATIC COMPUTERS

681.142 **1265**

An Autocorrelogram Computer.—G. Revesz. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, pp. 406–410.) A comparatively simple and inexpensive instrument is described, with detailed circuit diagram. The signal, recorded on a magnetic tape, is played back through two separate heads, thus producing the functions $f(t)$ and $f(t - \tau)$. These are amplified, multiplied and then integrated by a modified d.c. watt-hour meter. The computer was originally developed as a yarn cross-section analyser.

681.142 **1266**

Frequency Analysis of Computer Systems.—R. Boxer. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 228–229.)

681.142 **1267**

Australian Guided Weapons Analogue Computer.—(*Aust. J. Instrum. Tech.*, Nov. 1954, Vol. 10, No. 4, pp. 145–146.) Brief description of AGWAC, whose design is based on that of the Royal Aircraft Establishment simulator TRIDAC. The equipment is built up of 280 plug-in units ('bricks').

681.142 **1268**

Differential Analyser: the N.P.L.'s New Analogue Computer for solving Differential Equations.—(*Engineering, Lond.*, 19th Nov. 1954, Vol. 178, No. 4634, pp. 659–660.) Brief description of a large analyser, recently brought into use. The machine is actuated by a motor-driven shaft representing the independent variable. The three principal types of mechanism used are integrators, gear trains and differential gears. Function tables permit an arbitrary function of any variable to be inserted from the graph and also allow solutions to be obtained in graphical form. Setting-up time is low, since all units are coupled by means of servomechanisms which may be connected in any combination through a telephone-type switchboard.

681.142 **1269**

Algebraic Method of Synthesis of Multi-contact Relay Systems.—V. I. Shestakov. (*C. R. Acad. Sci. U.R.S.S.*, 21st Dec. 1954, Vol. 99, No. 6, pp. 987–990. In Russian.) A vector-algebraic method of synthesis of switching circuits suitable for computers is developed theoretically.

681.142 : 621.37 **1270**

Note on the Resistance-Network Analogue Solution of Field Problems of Spherical Symmetry.—G. Liebmann. (*Brit. J. appl. Phys.*, Nov. 1954, Vol. 5, No. 11, p. 412.) Results of a previous paper (945 of April) are applied to the derivation of design formulae for a resistance-chain analogue for solving the equation $\operatorname{div} K \operatorname{grad} U = g$ in cases of spherical symmetry.

CIRCUITS AND CIRCUIT ELEMENTS

534.213-8 : 621.396.6 **1271**

Bibliography on Ultrasonic Delay Lines.—M. D. Fagen. (*Trans. Inst. Radio Engrs*, Nov. 1954, No. PGUE-2, pp. 3–8.) 78 references are listed.

621.3.066.6 : 621.396.822 **1272**

Current Fluctuation Phenomena in Current-Carrying Sliding Contacts.—G. W. Epprecht. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1473–1480.) An account is given of an experimental investigation of sliding contacts as sources of interference voltages. The dependence of the noise characteristics on sliding speed and current intensity is examined. Most of the observed phenomena have a thermal origin. Several ranges of operation involving different mechanisms are distinguished.

621.314.263 **1273**

Odd-Integer Magnetic Frequency Multipliers.—L. J. Johnson & S. E. Rauch. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 168–173.) For various applications in the frequency range 400 c/s–20 kc/s, frequency multiplication can be performed more efficiently by magnetic than by electronic equipment. The operation of the magnetic multiplier is analysed and experimental units are described. For higher multiples, multistage arrangements are preferred. Harmonic distortion can be kept low by suitable choice of core materials.

621.318.5 **1274**

Component Design Trends — New Relay Materials improve Performance.—F. Rockett. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 144–148.) Tungsten-carbide contacts, nickel-iron armatures, stainless-steel springs, silicone damping fluids and self-shielded cores are among the materials discussed.

621.318.57 **1275**

Flip-Flop Counter has Expanded Range.—H. Beckwith. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 149–151.) Design procedure is indicated for counters having up to six stable states, without using feedback or matrixing. Long-term reliability is a primary objective. Crystal diodes are used in cross-coupling networks.

621.318.57 : 621.314.7 **1276**

Junction Transistor Switching Circuits.—T. A. Prugh. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 168–171.) A 75-transistor experimental switching system includes blocking oscillator, multivibrator, flip-flop, gating and adding circuits.

621.318.57 : 621.314.7 **1277**

A Method of designing Transistor Trigger Circuits.—F. C. Williams & G. B. B. Chaplin. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, p. 74.) Discussion on 2914 of 1953.

621.319.4 **1278**

The Behaviour of Polystyrene Capacitors under Alternating Voltage.—A. P. Butra & V. T. Renne. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 1974–1982.) Experiments at 50 c/s are reported. The main conclusions reached are: (*a*) heat treatment has no adverse effect on life; (*b*) for a given value of applied voltage the life is shortened if the voltage gradient is increased; (*c*) for a given ratio between applied voltage and initial ionization voltage the life is considerably shortened if ambient temperature is raised. Certain considerations regarding the impregnation of capacitors with mineral oil are discussed.

621.319.4 : 621.372.54 **1279**

Discoidal vs Tubular Feed-Through Capacitors.—H. M. Schlicke. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 174–178.) Tubular and disk-type ceramic feed-through capacitors for filtering purposes are compared in respect of their coupling impedance and its frequency dependence. The disk type is superior as regards h.f. performance and mechanical ruggedness. The necessary improved shielding methods are described.

621.37 : 621.314.7 **1280**

Interesting Applications of Transistor Technique.—W. W. Diefenbach. (*Funk-Technik, Berlin*, Nov. 1954, Vol. 9, No. 22, pp. 621–622.) Circuit diagrams and photographs are presented of various applications, including an a.f. amplifier moulded inside a record-player pickup arm.

621.37 : 621.314.7 **1281**

Practical Circuits using Transistors.—H. Salow. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 581–588.) Diagrams and descriptions of operation are given for amplifiers, oscillators and switching circuits.

621.37.029.64.049 **1282**

Integrated Microwave Circuits.—E. Jamieson. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 60–63.) Use of a milled-block construction for producing microwave assemblies is shown to offer advantages over more usual waveguide assemblies.

621.372 **1283**

A Definition of Passive Linear Networks in Terms of Time and Energy.—G. Raisbeck. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1510–1514.)

621.372.413 **1284**

Thermodynamic Consideration of Electromagnetic Cavity Resonators.—C. H. Papas. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1552–1553.) A simple method is presented for calculating the shift of resonance frequency produced by introducing a foreign body into the cavity.

621.372.413 : 621.385.029.6 **1285**

Tunable Cavity for X-Band Oscillators.—N. A. Spencer. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 135–137.) A rectangular-waveguide tuner for external-cavity reflex klystrons is described.

621.372.5 **1286**

Equivalent Circuit for a Passive Nonreciprocal Network.—H. A. Haus. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1500–1502.) A nonreciprocal quadripole is considered, comprising an ideal amplifier and phase shifter. Compared with the gyrator representation, this method facilitates the linking of the network parameters with measurements.

621.372.5 : 621.318.134 **1287**

Behavior and Applications of Ferrites in the Microwave Region.—A. G. Fox, S. E. Miller & M. T. Weiss. (*Bell Syst. tech. J.*, Jan. 1955, Vol. 34, No. 1, pp. 5–103.) Both reciprocal and nonreciprocal devices comprising ferrite-loaded waveguides are studied, the nonreciprocal effects in the latter being based on birefringence, phase shift, field displacement, and coupling through apertures, as well as on rotation of polarization. A method called 'point-field' analysis facilitates qualitative investigation. Definitions are given of the gyrator, the isolator and the circulator. Performance of some experimental devices is reported.

621.372.5.029.3.018.78 **1288**

An Investigation of the Nonlinear Distortion of a Quadripole using a Continuous Spectrum Signal.—V. M. Vol'f. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 2054–2063.) For measuring the nonlinear distortion introduced by an a.f. transmission system, it is necessary to use a continuous spectrum of frequencies with a given shape of the envelope. Relations are derived from which it is possible to calculate the spectra at the output of certain nonlinear systems for input signals covering a continuous band of frequencies and having envelopes represented by an exponential function or a difference between two exponential functions. As compared with tests using one or two spot frequencies, the results so obtained are more in accordance with results of subjective listening tests.

621.372.56.029.64 : 621.387 **1289**

The Theory and Design of Gas-Discharge Microwave Attenuators.—E. M. Bradley & D. H. Pringle. (*J. Brit. Instn Radio Engrs*, Jan. 1955, Vol. 15, No. 1, pp. 11–24.) "The theory of the interaction between a d.c. gas discharge and an r.f. field is considered and expressions developed for the complex conductivity of the discharge. The simple Lorentz theory is shown to give values of complex conductivity not very different from those derived with more detailed analyses. Problems connected with the gas discharge including that of noise production are considered. Practical microwave attenuators developed by the authors are described in detail. Two main classes of device are considered: (*a*) devices with resonant structures, and (*b*) distributed devices."

621.373 : 621.396.822 : 530.145 **1290**

Vacuum Fluctuation Noise and Dissipation.—J. Weber. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 556–559.) Continuation of previous investigation (2603 of 1954) of the interaction of an electron beam with the field in an enclosed region. An expression is derived for the observable mean squared e.m.f., and is used to calculate the fluctuations induced in the beam when interacting with a damped oscillator. As the damping becomes very large the fluctuations approach zero.

621.373.4 : 621.375.232.3 **1291**

Cathode-Follower-Coupled Phase-Shift Oscillator.—H. J. Reich. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, p. 229.) A note on the advantages of using cathode-follower amplifiers between the sections of the phase-shifting network.

621.373.422 **1292**

Circuits for producing High Negative Conductance.—H. J. Reich. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, p. 228.) Several arrangements using two triodes are illustrated; negative conductances of the order of 10 mhos can be produced. Stable oscillators can be made to operate with a supply voltage of 10 V or less.

621.373.43 : 621.375.23 **1293**

The Regenerative Pulse Generator.—C. C. Cutler. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 140–148.) Pulses are circulated repeatedly in a feedback loop including an expander and a filter, being alternately shortened in the expander and lengthened in the filter, and giving an output at each traversal. A loop gain of unity is maintained by a.g.c. For microwave pulses the nonlinear expander characteristic may be obtained by means of a crystal. Microwave pulses of duration down to 0·002μs and d.c. pulses down to 0·005μs have been produced. Possible applications include communications, radar and measurements, where coherent pulse trains are required.

621.373.44 **1294**

A Versatile Pulse Shaper.—G. E. Kaufer. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 78–81.) A triggered miniature-thyratron circuit is described for deriving sharp pulses with uniform amplitude and duration from an input of nonuniform pulses. A table shows the output waveform for various circuit arrangements and component values.

621.374.43 **1295**

Frequency Multiplication by Regenerative Modulation.—D. Makow. (*Canad. J. Technol.*, Nov. 1954, Vol. 32, No. 6, pp. 206–219.) A multiple-frequency generator is discussed in which operation depends on mixing a feedback and an input voltage. Theory is presented for a circuit designed to produce four multiples of the input frequency; experimental confirmation of the results is reported. Multiples up to the 40th have been obtained with good amplitudes; maximum amplitudes can be arranged to fall in desired frequency ranges. Even and odd multiples can be made available at separate output terminals. Operation is unaffected by variations of anode, filament or input voltage or by phase shifts due to aging of components in the feedback loop.

621.375.2 : 621.3.018.75 **1296**

Effect of Steepness of Rise and Fall of the Input Pulse on the Response of Pulse Amplifiers: Part 2.—B. K. Bhattacharyya. (*Indian J. Phys.*, Aug. 1954, Vol. 28, No. 8, pp. 371–395.) The response of a shunt-compensated amplifier to ramp-function and triangular pulses is analysed. Part 1: 2894 of 1954.

621.375.2.024 **1297**

A Stable and Sensitive D.C. Amplifier with High Input Resistance.—S. O. Nielsen & T. Rosenberg. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, pp. 401–404.) "A line-operated d.c. amplifier for automatic regulation using a.c. amplification and a breaker modulator has been designed with the following characteristics: direct reading instrument; zero drift after 'warming-up' less than 30 μV peak-to-peak in 12 hours' test; sensitivity (short-time stability) usually 10 μV; input resistance $3 \times 10^9\ \Omega$, and damping about 1 sec with $3 \times 10^8\ \Omega$ source resistance."

621.375.2.029.3 **1298**

New Amplifier has Bridge-Circuit Output.—D. J. Tomcik & A. M. Wiggins. (*Audio*, Nov. 1954, Vol. 38, No. 11, pp. 17–19.) The basic circuit is described and complete circuit diagrams are given of 20-W and 30-W a.f. amplifiers. The advantages of the circuit include (*a*) absence of switching transients, (*b*) absence of d.c. current through primary of output transformer, and (*c*) low quiescent current.

621.375.232 **1299**

Differential-Amplifier Design.—A. M. Andrew. (*Wireless Engr*, March 1955, Vol. 32, No. 3, pp. 73–79.) The possibility is discussed of providing good rejection of in-phase signals without using a balancing adjustment or specially selected components. To achieve the desired result by use of in-phase negative feedback, care must be taken that the feedback and input voltages are correctly combined. Two circuits are described illustrating the principles involved; both have the disadvantage of requiring floating batteries and isolated heater supplies.

621.375.234 **1300**

The Possibility of adjusting the Internal Impedance and varying the Gain in Amplifiers with Combined Current and Voltage Feedback.—W. Benz. (*Fernmeldetech. Z.*, July 1954, Vol. 7, No. 7, pp. 362–370.) The internal impedance can be reduced to and maintained at any desired level R_i, independent of the gain or the amount of feedback, by using a fixed amount of the total feedback to achieve the impedance reduction and apportioning the remainder so that $\frac{r}{k} = R_i$, where r and k are the current and voltage feedback factors of this remainder. Three commonly used circuits incorporating this feature are discussed.

621.375.3 : 621.317.3 **1301**

Magnetic Amplifiers and Weak Currents.—R. Klein. (*Bull. Soc. franç. Élect.*, Nov. 1954, Vol. 4. No. 47, pp. 649–674.) Particular attention is devoted to the use of magnetic amplifiers for measurement purposes.

621.375.4.029.3 : 621.314.7 : 621.396.822 **1302**

Investigations of Noise in Audio-Frequency Amplifiers using Junction Transistors.—P. M. Bargellini & M. B. Herscher. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 217–226.) Noise-factor measurements were made using various types of transistor in different circuit arrangements; the influence of input termination and operating point are discussed. Results are presented graphically. Three distinct sources are identified; shot noise and thermal noise are independent of frequency over the a.f. band, semiconductor noise varies approximately as $1/f$. Noise properties of transistors and thermionic valves are compared.

621.396.6 **1303**

Economic Aspects of Printed Foil Circuits.—P. Eisler. (*Research, Lond.*, Nov. 1954, Vol. 7, No. 11, pp. 441–447.)

GENERAL PHYSICS

530.19 **1304**

Search for a General Definition of Energy and of the Parameters of Extension and Intensity.—P. Renaud, M. Joly & D. G. Dervichian. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1603–1605.) A scheme of relations between energy and extension and intensity is presented which leads to definitions generally valid for all forms of energy including those as yet unknown.

534.21 + 538.566] : 537.228.1 **1305**

Conductivity and Viscosity Effects on Wave Propagation in Piezoelectric Crystals.—J. J. Kyame. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 990–993.)

534.26 + [535.42 : 538.566 **1306**

Diffraction of Pulses by a Circular Cylinder.—Friedlander. (See 1231.)

535.37 **1307**

Electroluminescence with Nonsinusoidal Fields.—S. Nudelman & F. Matossi. (*J. electrochem. Soc.*, Nov. 1954, Vol. 101, No. 11, pp. 546–553.) Experiments using pulses of rectangular, sawtooth and exponential form were made to supplement the information obtained by applying sinusoidal voltages [e.g., 3439 of 1952 (Piper & Williams)]. The phosphor investigated was ZnS: Cu,Pb, giving green and blue luminescent bands which were examined separately. Measurements were made of field and frequency dependence and decay law with square pulses; only qualitative observations were made with the other waveforms. A theoretical interpretation of the results is advanced.

535.376 **1308**

Voltage Dependence of Electroluminescent Brightness.—B. T. Howard, H. F. Ivey & W. Lehmann. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 799–800.) An equation of the form $L = a\,V \exp\,[-\,b/(V + V_0)]$ relating the brightness L to the voltage V is found to fit experimental data well, a, b and V_0 being constants.

537.21 **1309**

The Two-Dimensional Electric Field of a Curved-Sided Wall or Groove on an Infinite Plane.—N. H. Langton & N. Davy. (*Brit. J. appl. Phys.*, Nov. 1954, Vol. 5, No. 11, pp. 405–410.) Results of a theoretical investigation are tabulated and presented graphically. The calculation involves conformal transformations and elliptic integrals for complex moduli; values of the latter are tabulated.

537.226 **1310**

Some Properties of Dielectrics with High Permittivity.—M. Gourceaux. (*C. R. Acad. Sci., Paris*, 20th Dec. 1954, Vol. 239, No. 25, pp. 1777–1778.) Analysis shows that for a conductor surrounded by a dielectric of sufficiently high permittivity, the depth of penetration of h.f. current is dependent only on the constants of the dielectric. Formulae are derived, for solid and for hollow dielectric cylinders and spheres subjected to an alternating electric field, expressing the conditions under which the amplitude of oscillation of the bound electrons becomes infinite; the results can be stated in terms of characteristic radii for a given material and frequency.

537.311.1 **1311**

Theory of Electrical Conduction.—K. Ljolje. (*Z. Phys.*, 26th Nov. 1954, Vol. 139, No. 4, pp. 388–401.) General theory of conduction in pure metals is developed without assuming spherical symmetry for the energy levels. This is applied to calculate the conductivity of the alkali metals.

537.311.1 **1312**

The Theory of Electrical Resistance of Good Metallic Conductors.—C. A. Busse & F. Sauter. (*Z. Phys.*, 26th Nov. 1954, Vol. 139, No. 4, pp. 440–447.) Reasonable values are obtained for the resistivity of the alkali metals (except Li) by calculation based on the propagation of compression waves in an ionic continuum.

537.311.62 : 621.365.5 **1313**

Electromagnetic Heating of Thin Layers of Conductors or Semiconductors; Generalizations relating to the Problem of the Determination of the Ideal Thickness.—M. Gourceaux. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1607–1609.) Formulae are quoted for the thickness of a cylindrical and of a spherical metal shell to make optimum use of the heating effect of a h.f. magnetic field. If the metal is replaced by a material which is both a conductor and a dielectric, the corresponding expressions are quite different though the ratio between them is the same. Consideration is also given to the case of a cylindrical shell rotated rapidly in a uniform constant transverse magnetic field.

537.52 **1314**

Artificial Increase of Electrical Breakdown Strength of Air at Low Pressure in the Region of 300 Mc/s.—G. W. E. Stark & G. L. Fougere. (*Nature, Lond.*, 4th Dec. 1954, Vol. 174, No. 4440, p. 1066.) Measurements covering the pressure range 5–120 mm Hg, using gap widths of 1–4 mm and frequencies of 227 and 379 Mc/s are reported. Under these conditions, the superposition of a moderate direct voltage on the alternating voltage can increase the u.h.f. breakdown stress quite considerably. Typical results obtained with direct voltages up to 125 V are shown graphically; the effect is large enough to find practical application as an inhibitor of breakdown in electronic equipment for operation at high altitudes.

537.529 : 537.58 **1315**

Theory of Electric Breakdown in the High-Temperature Region and its Relation to Thermionic Emission.—K. Lehovec. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 921–928.) Discussion is based on consideration of the distribution of electrons over the energy states, rather than the behaviour of individual electrons.

537.533.8 **1316**

Energy Distribution of Secondary Electrons from Magnesium and Beryllium Alloys.—V. N. Lepeshinskaya & V. M. Tumorin. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 1933–1941.) Experiments were carried out at a pressure of $2–4 \times 10^{-6}$ mm Hg with alloys CuMg, AgMg, AlMg and CuBe activated by heating either in a vacuum or in an atmosphere of oxygen. Curves showing the dependence of the secondary emission coefficient on the energy of primary electrons and of the secondary current on the voltage at the collector are plotted. The mechanism of secondary emission from complex surfaces is not considered to be similar to that of the Malter effect; the role of the accelerating field is probably reduced here to the compensation of local retarding fields above the inhomogeneous surface of the activated layer.

537.533.8 **1317**

The Secondary Electron Emission of Sodium and Zinc.—J. Woods. (*Proc. phys. Soc.*, 1st Nov. 1954, Vol. 67, No. 419B, pp. 843–844.) Experiments are described in which the metal to be examined was deposited on a copper target block in a valve with a guiding grid accurately aligned with a collector grid. The collector potential was high enough for saturation secondary current. To introduce the sodium an electrolytic method was used. For sodium, the maximum secondary emission factor reached a peak value of 1·2 during the coating process and then fell to a constant value of 0·82, occurring at a target potential of 300 V. For zinc, the maximum value of 1·15 occurred at a target potential of 200 V.

537.56 : 538.63 **1318**

Non-Maxwellian Theory of Homogeneous Anisotropic Plasmas.—R. Jancel & T. Kahan. (*Nuovo Cim.*, 1st Nov. 1954, Vol. 12, No. 5, pp. 573–612. In French.) Using theory based on Boltzmann's integro-differential equation, a calculation is made of the distribution of electron velocities in an ionized gas subjected to a constant magnetic field, for non-Maxwellian conditions. Explicit expressions are derived for the magneto-ionic conductivity, dielectric tensor, Hall effect, deflection of an electron beam, and a generalized form of Langevin's mobility formula. Results are compared with those obtained by other methods based on mean free path. Wave propagation is studied, formulae being derived for refractive index, birefringence, phase and group velocities, attenuation, polarization, and critical frequencies. Classical results of ionosphere theory are confirmed. See also 3196 of 1954 and back references.

537.56 : 538.65 **1319**

Magnetic Fields in Plasmas with Turbulent Motion.—P. O. Schilling & W. Lochte-Holtgreven. (*Z. Naturf.*, June 1954, Vol. 9a, No. 6, pp. 520–526.) When a plasma comprising electrons and ions is in turbulent motion, diffusion currents give rise to magnetic fields. These can be demonstrated by rotating the gases produced by burning a mixture of oxygen and propane. An account is given of suitable experimental technique.

538.221 **1320**

Spin Precession in a Vibrating Bloch Wall at Small Amplitudes.—I. Lucas. (*Z. Naturf.*, May 1954, Vol. 9a, No. 5, pp. 373–376.) The natural frequency of vibration of the wall is derived on the basis of an effective internal magnetic field. The formula obtained for a 180° wall is identical, except for a factor $\sqrt{2}$, with that given by Döring (*ibid.*, 1948, Vol. 3a, p. 373) for a 90° wall, on the basis of the wall mass.

538.3 **1321**

Electromagnetism, Old and New.—F. W. Warburton: P. Moon & D. E. Spencer. (*J. Franklin Inst.*, Nov. 1954, Vol. 258, No. 5, pp. 395–400.) Comment on 2923 and 2924 of 1954 and authors' reply.

538.3 **1322**

Energy of the Harmonic Oscillator in Vacuum.—P. Braffort & C. Tzara. (*C. R. Acad. Sci., Paris*, 20th Dec. 1954, Vol. 239, No. 25, pp. 1779–1780.) Continuation of work abstracted previously [3200 of 1954 (Braffort et al.)]. The term 'energy of the oscillator' is used to indicate the additional energy acquired by a free charge on passing into the oscillating state. The energy of the harmonic oscillator in the fluctuating field of the absorber is equal to the product of its natural frequency and a universal constant.

539.15 **1323**

Electronic Band Structure of Solids.—C. A. Coulson. (*Nature, Lond.*, 20th Nov. 1954, Vol. 174, No. 4438, pp. 949–950.) Brief report of conference held at the Radar Research Establishment at Malvern in September 1954, at which criticisms of the energy-band theory were advanced.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **1324**

The Isotropic Component of Cosmic Radio-Frequency Radiation.—J. R. Shakeshaft. (*Phil. Mag.*, Nov. 1954, Vol. 45, No. 370, pp. 1136–1144.) Possible sources of the isotropic component deduced by Westerhout & Oort (419 of February) are discussed. The integrated radiation from normal extragalactic nebulae is shown to be inadequate to account for the observations, which may be explained on the basis of collisions between galaxies. The intensity to be expected depends strongly on the cosmological theory assumed, hence accurate measurements of the extragalactic component may yield information of value for distinguishing between different theories.

523.746 **1325**

Prediction of the Present Sunspot Cycle.—A. G. McNish & J. V. Lincoln. (*Trans. Amer. geophys. Union*, Oct. 1954, Vol. 35, No. 5, pp. 709–710.) The reliability of the prediction method presented previously (*ibid.*, 1949, Vol. 30, pp. 673–685) is examined with reference to observed sunspot data for the period 1944–1954.

523.78 **1326**

Observation of the Total Eclipse of the Sun on 30th June 1954 at Hagaby (Sweden), and of the Partial Eclipse using the Radio Telescope at Meudon Observatory.—M. Laffineur, B. Vauquois, P. Coupiac & W. N. Christiansen. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1589–1590.) The curve obtained from the observations in Sweden at 545 Mc/s was less irregular than that observed at Khartoum in 1952; this is consistent with the lower level of solar activity. At totality, the residual radiation was 11%, compared with 19·5% in 1952.

550.3 : 551.5 **1327**

Symposium on Scientific Aspects of the International Geophysical Year 1957–1958.—(*Proc. nat. Acad. Sci., Wash.*, Oct. 1954, Vol. 40, No. 10, pp. 922–982.) The text is given of a number of papers, including the following:—

Morphology of Ionospheric Storms (pp. 931–943).—H. G. Booker.
The Morphology of the Aurora (pp. 943–950).—A. B. Meinel.
Diurnal and Seasonal Variation of the Airglow (pp. 950–956).—F. E. Roach.
Transport Problems in the Atmosphere (pp. 956–966).—H. Wexler.
Evidence for Winds in the Outer Atmosphere (pp. 966–972).—F. L. Whipple.
Solar Activity and Terrestrial Disturbances (pp. 973–978).—D. H. Menzel.
Geographic Basis for Antarctic Scientific Observations (pp. 978–982).—P. A. Siple.

550.38 **1328**

Homogeneous Dynamos and Terrestrial Magnetism.—E. Bullard & H. Gellman. (*Phil. Trans. A*, 30th Nov. 1954, Vol. 247, No. 928, pp. 213–278.) Solutions of Maxwell's equations are obtained for a sphere of electrically conducting fluid in which there are specified velocities. Solutions exist when harmonics up to degree four are included, but for a greater number of harmonics the convergence of solutions has not been proved. Orders of magnitude are derived for a number of quantities connected with the dynamo theory of terrestrial magnetism.

550.385.21 : 551.510.535 **1329**

Possible Cause of Disturbance of Solar Diurnal Variation of Geomagnetic Field.—B. E. Bryunelli. (*C. R. Acad. Sci. U.R.S.S.*, 11th Dec. 1954, Vol. 99, No. 5, pp. 741–743. In Russian.) A mechanism is considered whereby currents in the ionosphere acquire a pattern such as to produce the observed S_D variations of the geomagnetic field.

550.388.8 : 551.510.53 **1330**

Infrared Radiation of Night Sky.—V. I. Krasovski. (*Uspekhi fiz. Nauk*, Nov. 1954, Vol. 54, No. 3, pp. 469–494.) A survey. Production of infrared radiation in the upper atmosphere is discussed and the estimates given by various authors for the heights at which radiation is produced are quoted. The heights coincide roughly with the D and E layers. 70 references, including about 30 to Russian literature.

551.510.5 : 523.72 **1331**

Seasonal Variation in the Absorption of Solar Radiation by Atmospheric Ozone at 9·6 Microns.—A. Adel. (*Bull. Amer. met. Soc.*, June 1954, Vol. 35, No. 6, pp. 250–252.)

551.510.52 : 551.594.13 **1332**

Aircraft Investigation of the Large Ion Content and Conductivity of the Atmosphere and their Relation to Meteorological Factors.—R. C. Sagalyn & G. A. Faucher. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 253–272.) Continuation of work described previously [1289 of 1952 (Callahan et al.)]. Simultaneous measurements of conductivity, large-ion concentration, temperature and humidity over the altitude range 700–15 000 ft are reported. The results indicate that over continental areas in fair weather there exists a layer adjacent to the ground, varying in height from 1 000 to 10 000 ft, in which the vertical distributions of large ions and conductivity are controlled primarily by atmospheric turbulence. At the upper boundary of this layer there is a transition region about 800 ft high in which the conductivity increases by a factor of 1·5–6 while the large-ion content decreases by a factor of 1·5–100. Above this region the large-ion content is reduced to a very low value and the conductivity is determined primarily by the intensity of cosmic radiation.

551.510.53 **1333**

Reviews of Modern Meteorology—11. The Physical State of the Upper Atmosphere.—K. Weekes. (*Quart. J. R. met. Soc.*, Jan. 1954, Vol. 80, No. 343, pp. 2–15.) The composition of the atmosphere at various levels is discussed, mainly as regards the constituents N_2 and O_2; this provides an indication of the value to be assigned to the mean molecular weight in the formula for converting scale height to temperature. Following the discussion of the properties of the static atmosphere, the evidence for movement in the high atmosphere is reviewed, and the complications to be expected in the upper levels of the ionosphere as a result of the interaction of the ionized gas with the earth's magnetic field are considered.

551.510.535 **1334**

Determination of Electron Densities in the Ionosphere from Experimental (*h′*, *f*,) Curves.—H. A. Whale. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, p. 351.) An error in the argument used in the original paper (2177 of 1951) was pointed out by Kelso (2088 of 1954); it is suggested that it may nevertheless be possible to provide a rigorous argument justifying the use of the curves given.

551.510.535 **1335**

Concentration of Hydroxyl in the Upper Atmosphere.—V. I. Krasovski. (*C. R. Acad. Sci. U.R.S.S.*, 21st Dec. 1954, Vol. 99, No. 6, pp. 979–981. In Russian.) A brief critical discussion of possible reactions and their equilibria at heights of about 100 km.

551.510.535 **1336**

The Physics of the Ionosphere.—J. A. Ratcliffe. (*Proc. Instn elect. Engrs*, Part I, Nov. 1954, Vol. 101, No. 132, pp. 339–346.) A brief survey of selected aspects of recent research on the ionosphere.

551.510.535 **1337**

The Anomalous Equatorial Belt in the F_2-Layer.—E. V. Appleton. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 348–351.) An examination has been made of the relation between N_m (the maximum electron density) and geomagnetic latitude for hours of the equinox day other than noon. The abnormally low values of N_m found over a 4 000-km-wide equatorial belt at noon tend to disappear during the afternoon and to be replaced by abnormally high values during the evening; the anomaly disappears between midnight and 0300 h. These variations appear to be due to a contraction of the vertical extent of the F_2 layer during the first half of the night, and an expansion prior to noon.

551.510.535 **1338**

F_2-Layer Regularities at Ibadan.—N. J. Skinner & R. W. Wright. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 290–297.) Analysis of records for the period December 1951–January 1953 confirms that the daily variation of n (the total electron content in a column of unit cross-section below the height of maximum ionization in the F_2 layer) is relatively free from anomalies exhibited by the corresponding variation of N_m (the maximum electron density of the F_2 layer). In calculating n, the non-parabolic electron distribution at Ibadan must be taken into account. Inclusion of the F_1-layer electron contribution has no appreciable effect on the regularity of the daily variation. A new method is described for deducing the recombination coefficient and the rate of ion production from the variation of n. The phenomenon of sunset minimum of $h'F_2$ is discussed; reasons are given for considering it a spurious effect arising from errors in the reduction of records.

551.510.535 : 523.78 **1339**

Preliminary Results of Ionospheric Observations of the Solar Eclipse of 30th June 1954.—K. Bibl & F. Delobeau. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1658–1660.) Ionosphere soundings were made in the zone of totality, from a ship off the coast of southern Norway. A panoramic instrument was used covering the frequency range 1–20 Mc/s in 12 sec; a second instrument was used for absorption measurements at 1·43, 2·09, 2·86 and 4·18 Mc/s. The variation of the maximum electron concentrations for the different layers is shown graphically. The recombination coefficients are estimated (*a*) from the delay between the optically and the ionospherically observed maximum phase, and (*b*) by trying different values in the equilibrium equation expressing the dependence of electron concentration on unobscured fraction of the solar disk. α_2, the recombination coefficient for a normal law, is greater than or equal to 5×10^{-8} cm^3/s for the E and F_1 layers and over 5×10^{-9} cm^3/s for the F_2 layer.

551.510.535 : 621.396.11 **1340**

The Physics of the Ionosphere.—(*Nature, Lond.*, 6th Nov. 1954, Vol. 174, No. 4436, pp. 866–868.) Report of conference held at Cambridge, England, in September 1954, at which papers were presented and discussed summarizing existing knowledge of the subject.

551.510.535 : 621.396.11 **1341**

Simultaneous Ionospheric Absorption Measurements at Widely Separated Stations.—Beynon & Davies. (See 1469.)

551.510.535 : 621.396.822 **1342**

Ionospheric Thermal Radiation at Radio Frequencies: Part 2—Further Observations.—F. F. Gardner. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 298–315.) Continuation of work reported previously [406 of 1952 (Pawsey et al.)]. Observations were made at frequencies near 2 Mc/s, over a period of about a year, at a site chosen to minimize man-made noise. The location of the absorbing regions was deduced from consideration of pulse-echo observations of the D region made on 2·28 Mc/s [132 of 1954 (Gardner & Pawsey)]. The ionosphere temperatures deduced ranged from about 200° to 250°K, varying appreciably from day to day and being lower and less variable in winter. An increase of up to 40° during sudden ionospheric disturbances is probably due to a change of height of the 2-Mc/s absorbing region. Polarization measurements in September 1951 indicated that the absorbing regions were then located at a level where the temperature decreased with height.

551.510.535 : 621.396.822 : 523.16 **1343**

Effects of Solar Flares on the Absorption of 18·3-Mc/s Cosmic Noise.—C. A. Shain & A. P. Mitra. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 316–328.) Abnormal variations of ionospheric absorption were investigated during the course of the observations reported previously (1426 of 1954). Most cases of unusually high absorption appear to be associated with solar flares. Observations of the increases in absorption during the resulting sudden ionospheric disturbances are compared with observations of sudden phase anomalies in waves reflected from the ionosphere; a 1-db absorption difference appears to correspond to a phase anomaly of about 200° at the frequency considered. As a method of detecting sudden ionospheric disturbances, observation of the absorption variation is as sensitive as and more convenient than observation of phase anomalies. Evidence was found of a delayed increase of absorption about 30 hours after some solar flares; the magnetic records showed no abnormal features at these times, and it is uncertain whether the excess absorption occurs within the ionosphere or outside it.

551.593 **1344**

Theoretical Considerations regarding the Dayglow.—D. R. Bates & A. Dalgarno. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 329–344.) Results of rocket observations made by Miley et al. (*Trans. Amer. geophys. Union*, 1953, Vol. 34, p. 680) are examined; the reported great altitude and luminosity of the emissive source cannot be reconciled with the assumption that dayglow is due to direct photo-action by incident solar radiation. A determination is made of the emission to be expected from processes known to be operative, including resonant and fluorescent scattering, photodissociation, photo-ionization and recombination.

551.594.21 **1345**

Chain-Process of Accumulating Charges in Thunderclouds.—V. M. Muchnik. (*C. R. Acad. Sci. U.R.S.S.*, 1st Dec. 1954, Vol. 99, No. 4, pp. 537–538. In Russian.) Theoretical considerations lead to the conclusion that the build-up of charge in a thundercloud follows an exponential law.

551.594.21 **1346**

Field Intensities and Charge Densities in Thunderclouds.—H. Norinder & W. Pucher. (*Ark. Geofys.*, 22nd Nov. 1954, Vol. 2, Part 2, pp. 97–107.) Calculations based on the assumption that the thundercloud is ellipsoidal give the maximum field strength in the cloud as 1–5 kV/cm and the charge density as 10^{-5}–2.10^{-5} e.s.u./cm^3. The conditions under which lightning discharges may be initiated are discussed.

551.594.22 : 621.396.963.3 **1347**

Radar Echoes from Lightning.—Jones. (See 1356.)

551.594.6 : 621.396.11 **1348**

The Wave-Forms of the Electric Field in Atmospherics recorded simultaneously by Two Distant Stations.—H. Norinder. (*Ark. Geofys.*, 22nd Nov. 1954, Vol. 2, Part 2, pp. 161–195.) Electric-field variations were recorded at two stations, one near Uppsala, the other at Fotevik at the south-western tip of Sweden, during September 1949, and the variations were correlated with thunderstorms which occurred at distances between 240 and 2 400 km from Uppsala. In pre-discharge atmospherics a quasi-periodic variation was observed which corresponded, most frequently, to a wavelength of 11 km. The waveforms of the main discharges varied greatly with distance, often in a quasi-periodic manner. A unipolar form was also observed. The mean waveform, obtained from several hundreds of oscillograms, shows five pulses reflected from the ionosphere in addition to the ground pulse. Waveform changes with distance travelled can only be calculated by making large simplifications. Numerous oscillograms are reproduced and discussed.

LOCATION AND AIDS TO NAVIGATION

621.396.93 **1349**

H.F. Direction Finding.—C. G. McCue. (*Wireless Engr*, March 1955, Vol. 32, No. 3, pp. 79–81.) "Some night-time d.f. observations were made at the Radio Research Organization's stations at Slough and Winkfield on h.f. radio signals from Sterling, Virginia, U.S.A., during February and March 1953. The purpose of these measurements was to test whether the observed bearings depended upon the direction of the transmitting aerial beam. No significant correlation of this nature was disclosed."

621.396.93(083.71) **1350**

I.R.E. Standards on Radio Aids to Navigation: Definitions of Terms, 1954.—(*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 189–209.) Standard 54 I.R.E. 12Sl.

621.396.933 **1351**

Radio Navigation Methods and their Evaluation.—E. Kramar. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 571–576.) A review of known systems of aircraft navigation aids, from the point of view of the operator.

621.396.933.4 **1352**

Ground-Controlled Approach Systems.—A. Hunkeler. (*Bull. schweiz. elektrotech. Ver.*, 27th Nov. 1954, Vol. 45, No. 24, pp. 1018–1023.) An illustrated description of civilian and military uses of G.C.A.

621.396.96 **1353**

Application of Radar in National Defence.—J. H. Leutwyler. (*Bull. schweiz. elektrotech. Ver.*, 27th Nov. 1954, Vol. 45, No. 24, pp. 1009–1018.) An illustrated account is presented of some ground and airborne radar equipment tested by the Swiss Army. Requirements for various units and for the coordination of units are outlined.

621.396.96 : 519.21 **1354**

On the Effect of Integration in a Pulsed Radar, Randomly Modulated Carrier.—W. M. Stone. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1543–1548.) Results obtained previously (3602 of 1953) on statistical theory of detection are extended to include the case of integration of N pulses before a decision is reached by the detector associated with a pulsed radar system. Sets of curves show the probability of detection as a function of average signal/noise power ratio.

621.396.96 : 621.396.621 **1355**

Design of a Logarithmic Receiver.—S. Rozenstein. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 69–74.) A receiver of the successive-detection type for pulsed radar is discussed. Details are given of an i.f. stage designed to maintain the screen-grid voltage constant. A video amplifier is described including a differentiating circuit for signals of large dynamic range with negligible overshoot. Conclusions are drawn for the practical application of this receiver with various indicators.

621.396.963.3 : 551.594.22 **1356**

Radar Echoes from Lightning.—R. F. Jones. (*Quart. J. R. met. Soc.*, Oct. 1954, Vol. 80, No. 346, pp. 579–582.) A-scope records are shown which were obtained in August 1953 using a wavelength of 10 cm and a stationary aerial. A possible distribution of the charge in a thundercloud is deduced.

621.396.963.325 **1357**

Suppression of Fixed-Target Echoes in Radar: Application of the Doppler Effect.—M. Wildi. (*Bull. schweiz. elektrotech. Ver.*, 27th Nov. 1954, Vol. 45, No. 24, pp. 1023 . . 1047.) An outline of moving-target-indicator systems is given. Suppression is based on the electrical subtraction of two successive echoes; the effectiveness of this depends on the level of instabilities and these are estimated. Some measured values are also given.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **1358**

A Thermionic Ionization Gauge of High Sensitivity employing a Magnetic Field.—G. K. T. Conn & H. N. Daglish. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, pp. 412–415.) The gauge comprises a cylindrical anode, an axial filament and a pair of ion-collecting end-plates. In operation an axial magnetic field of the order of 150 oersted is used; the gas pressure is then determined by measurement of the ion current. The sensitivity is $800\,\mu$A per micron pressure at an emission corresponding to 1 mA anode electron current, with no field, and $7\,000\,\mu$A/micron at 2 mA; this is of the order of 100 times the sensitivity of a conventional thermionic gauge.

531.788.7 **1359**

The Influence of the Ballast Resistance on the Performance of Penning Vacuum Gauges.—G. K. T. Conn & H. N. Daglish. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, pp. 433–434.) A brief note.

531.788.7 : 621.376.3 **1360**

Recording Vacuum Gauge.—D. T. Hurd & M. L. Corrin. (*Rev. sci. Instrum.*, Nov. 1954, Vol. 25, No. 11, pp. 1126–1128.) The gauge described is a modification of the Langmuir type; the frequency of an oscillator is arranged to depend on the varying capacitance between a stationary electrode and an oscillating fibre whose damping is a function of the pressure of the ambient gas.

533.5 **1361**

An Instrument for Leak Detection and Pressure Measurement in High-Vacuum Systems.—E. G. Leger. (*Canad. J. Technol.*, Nov. 1954, Vol. 32, No. 6, pp. 199–205.) The instrument described is suitable for measurements of gas pressure in the range 10^{-1}–10^{-7} mm Hg. Leaks are detected by spraying oxygen on the outside of the vacuum system and noting the decrease in electron emission from a tungsten filament in an ionization gauge when it is operated as a saturated diode. Indication is given either by a meter or by the variation of frequency of an a.f. oscillator.

535.37 **1362**

Modifications of Electroluminescence under the Influence of Temperature.—J. Mattler. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1616–1618.) Measurements were made on ZnS phosphors, variously activated, over the temperature range −166° to +155°C. An experimental arrangement was used which did not introduce temperature effects due to the supporting dielectric. The applied voltage ranged from 125 V to 900 V. In one group of phosphors the electroluminescence decreased monotonically over the temperature range, in another group the electroluminescence passed through a maximum value at room temperature. Variations of spectral distribution as well as intensity were observed. A theoretical interpretation of the results is outlined.

535.376 **1363**

Cathodo-Luminescence of MgO.—B. D. Saksena & L. M. Pant. (*Proc. phys. Soc.*, 1st Nov. 1954, Vol. 67, No. 419B, pp. 811–816.) The effects on the luminescence spectra of exposure to cathode rays and of heating are examined experimentally and the results are interpreted in terms of impurity-centre processes.

535.376 : 546.47-31 **1364**

Luminescence Mechanism of Zinc Oxide Phosphors.—H. Gobrecht, D. Hahn & K. Scheffler. (*Z. Phys.*, 26th Nov. 1954, Vol. 139, No. 4, pp. 365–371.) Investigation shows that the decay of luminescence in the ultraviolet and green bands after electron-beam excitation and, down to −60°C, in the green band after long-wave ultraviolet excitation is exponential. A thermoluminescence maximum occurs at 118°K. The temperature characteristic of luminescence is independent of the excitation intensity. This is not compatible with a recombination mechanism suggested earlier [3442 of 1952 (Gobrecht et al.)]. Similarity with the luminescence characteristics of barium platinocyanide is noted.

537.226 : 621.315.612.4 **1365**

Structural and Dielectric Studies in the System (Ba, Ca) (Ti, Zr)O_3.—M. McQuarrie & F. W. Behnke. (*J. Amer. ceram. Soc.*, Nov. 1954, Vol. 37, No. 11, pp. 539–543.) "The crystalline phases in the system (Ba, Ca) (Ti, Zr)O_3 were identified and their lattice dimensions were determined from X-ray powder patterns of fired ceramic disks. Compositions near the $BaTiO_3$-$BaZrO_3$ and $CaTiO_3$-$CaZrO_3$ sides of the composition square gave evidence of complete solid solution, whereas all intermediate compositions contained two separate phases. Variations in the temperature of the Curie point and in aging rate were found to correlate reasonably well with variations in the character of the crystal structure."

537.226 : 621.372.22 **1366**

The Relative Permittivity of Tetragonal Arrays of Perfectly Conducting Thin Discs.—J. Brown & W. Jackson. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 37–42.) "The methods available for the calculation of the interaction field of an array of dipoles are discussed with reference to an artificial dielectric formed from a tetragonal array of conducting discs. A modified method is described and used to derive a formula for the relative permittivity, valid when the discs are not too closely spaced. For closely packed discs, the fields due to higher-order multipoles become important and a second formula for the relative permittivity is obtained for this case. Comparison with experimental values already obtained shows that the two formulae together enable the calculation of the relative permittivity over the whole range of spacings likely to be used in practice to be made."

537.226 : 621.372.22 **1367**

The Properties of Artificial Dielectrics at Centimetre Wavelengths.—J. Brown & W. Jackson. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 11–16.) The properties of the artificial dielectric are compared with those of a solid dielectric, and possible definitions of refractive index and wave impedance are examined. The latter is most appropriately defined in terms of the reflection coefficient at an interface between the dielectric and free space. The reactive fields set up near such an interface are examined qualitatively, and ways of representing them are discussed. Possible applications of artificial dielectrics other than as aerials are mentioned.

537.226 : 621.396.677.85 : 621.372.22 **1368**

Some Experiments on Artificial Dielectrics at Centimetre Wavelengths.—El-Kharadly. (See 1261.)

537.226 : 621.396.677.85 : 621.372.22 **1369**

A General Experimental Method to determine the Properties of Artificial Media at Centimetre Wavelengths, applied to an Array of Parallel Metallic Plates.—Primich. (See 1262.)

537.227 + 621.315.612 **1370**

Dielectric Properties and Phase Transitions of $NaNbO_3$ and $(Na,K)NbO_3$.—G. Shirane, R. Newnham & R. Pepinsky. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 581–588.) Optical, X-ray and dielectric measurements on single-crystal and ceramic specimens of $NaNbO_3$ and solid solutions of $(Na,K)NbO_3$ are reported. No evidence was found of ferroelectricity in $NaNbO_3$; a small addition of $KNbO_3$ produced a ferroelectric phase. The phase transitions in $NaNbO_3$ are quite different from those in $KNbO_3$.

537.227 **1371**

Ferroelectric Properties of Single Crystals.—C. F. Oxbrow. (*Nature, Lond.*, 11th Dec. 1954, Vol. 174, No. 4441, pp. 1091–1093.) Report of a colloquium held at Christchurch, England, in September 1954.

537.227 : 546.431.824-31 + 547.476.3 **1372**

Ferroelectric Ceramics with Very Pronounced Nonlinear Properties.—T. N. Verbitskaya. (*C. R. Acad. Sci. U.R.S.S.*, 1st Jan. 1955, Vol. 100, No. 1, pp. 29–32. In Russian.) A comparison is made of the variation of the dielectric constant with applied electric field for Rochelle salt, $BaTiO_3$, T-7500, and Varikond VK-1. The last-mentioned is similar to Rochelle salt in respect of the large change of the dielectric constant in fields up to 1 kV/cm. Experimental results are presented graphically.

537.227 : 546.431.824-31 **1373**

Infrared Spectrum of Barium Titanate.—R. T. Mara, G. B. B. M. Sutherland & H. V. Tyrell. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 801–802.) Observations are reported and are discussed in the light of theories about the ferroelectric character of $BaTiO_3$.

537.227 : 546.431.824-31 : 621.396.822 **1374**

Noise Generation in Crystals and in Ceramic Forms of Barium Titanate when subjected to Electric Stress.—A. C. Kibblewhite. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 59–68.) Variation of the noise is investigated experimentally as a function of the electric stress on the material and of its temperature relative to the Curie point. The existence of a Barkhausen effect associated with the ferroelectric domain structure is established. From the results obtained on crystals an estimate is made of the effective volume of the individual domains. In ceramics additional noise is observed, the origin of which is not yet certain.

537.228.1 **1375**

Piezoelectrically Excited Vibrations of Plates and Rods, and Dynamic Determination of Elastic and Piezoelectric Constants.—R. Bechmann. (*Arch. elekt. Übertragung*, Nov. 1954, Vol. 8, No. 11, pp. 481–490.) Two methods of determining the piezoelectric constants are discussed, (*a*) from equivalent-circuit dynamic-capacitance considerations, and (*b*) from measurements of resonance and antiresonance frequencies. Method (*a*) is independent of the dielectric properties of the material; method (*b*) depends on the parallel capacitance and hence on the dielectric properties, and permits evaluation of an equivalent dielectric constant whose value depends on the mode of vibration. The theoretical results are supported by measurements on ADP and $BaTiO_3$ ceramic plates.

537.228.1 **1376**

Piezoelectric Effect in Minerals.—M. P. Volarovich & E. I. Parkhomenko. (*C. R. Acad. Sci. U.R.S.S.*, 11th Nov. 1954, Vol. 99, No. 2, pp. 239–242. In Russian.) A mainly qualitative experimental investigation of piezoelectricity in natural minerals is reported. Oscillograms are shown. The largest effect, observed in granite, is of the order of several hundredths of the effect in pure quartz. Smaller effects were observed in sandstone and quartzite; no effect in jasper, sienite, marble, dolomite, and limestone.

537.311.31 : 539.23 **1377**

Conductivity of Films in Longitudinal Magnetic Field.—M. Ya. Azbel'. (*C. R. Acad. Sci. U.R.S.S.*, 1st Dec. 1954, Vol. 99, No. 4, pp. 519–522. In Russian.) A theoretical treatment of electronic conduction in metallic films, for the case of parallel electric and magnetic fields.

537.311.33 **1378**

Electrical Conduction in Non-metallic Solids.—C. W. Oatley. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 7–10.) Conduction by electrons in nearly perfect crystals is considered, a gravitational analogue being used to explain the motion of the electrons in the electric field. Production of free carriers by heating and by radiation is discussed.

537.311.33 **1379**

A Unidimensional Model of Semiconductor Compounds of Type $A^{III}B^{V}$.—B. Seraphin. (*Z. Naturf.*, May 1954, Vol. 9a, No. 5, pp. 450–456.) The main differences between semiconductor compounds of this type and semiconductors of Group-IV type are increased energy gap and electron mobility, lower hole mobility, and increased bond strength. The one-dimensional representation of the potential variation through the lattice shows how these differences result from the presence of alternate shallow and deep troughs in place of equal-depth troughs.

537.311.33 **1380**

Measurements on some Semiconducting Compounds with the Zinc-Blende Structure.—F. A. Cunnell, J. T. Edmond & J. L. Richards. (*Proc. phys. Soc.*, 1st Nov. 1954, Vol. 67, No. 419B, pp. 848–849.) The infrared transmission was measured for polished specimens of AlSb, GaSb, InSb, InAs, InP and GaAs; the curves are shown and deduced values of the optical activation energy are tabulated. Hall constant and conductivity were measured for GaSb, InSb and GaAs, and the electron concentrations and mobilities were determined; these figures are included in the table.

537.311.33 **1381**

Stability of Vertical Fusion Zones.—W. Heywang & G. Ziegler. (*Z. Naturf.*, June 1954, Vol. 9a, No. 6, pp. 561–562.) Recrystallization of semiconductors from the molten lower end of a vertically held rod is considered. A brief analysis indicates a maximum height of the molten zone for stability at a given radius of the solid rod.

537.311.33 : 535.215.3 : 538.639 **1382**

Theory of the Photomagnetic Effect in Semiconductors in High-Intensity Magnetic Fields.—A. I. Ansel'm. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 2064–2069.) A brief review of theoretical papers on the subject is given, and a differential theory of the effect is developed, i.e. the value of the electric field along one of the axes is determined for a given gradient of the concentration of current carriers along this axis and a given value of the magnetic field along the other axis. Differences in the results obtained for the ionic and atomic types of semiconductor are indicated and interpreted.

537.311.33 : 537.213 **1383**

The Potentials of Infinite Systems of Sources and Numerical Solutions of Problems in Semiconductor Engineering.—A. Uhlir, Jr. (*Bell Syst. tech. J.*, Jan. 1955, Vol. 34, No. 1, pp. 105–128.) "Tables and charts are given of mathematical functions related to the potential of a line of point charges. The use of these functions is illustrated by applications to semiconductor resistivity measurements and to calculations of the base resistance of point-contact transistors."

537.311.33 : 537.322.1 : 621.56 **1384**

The Use of Semiconductors in Thermoelectric Refrigeration.—Goldsmid & Douglas. (See 1465.)

537.311.33 : 538.63 : 535.215.9 **1385**

Origin of E.M.F. on Illumination of Semiconductors in Inhomogeneous Magnetic Field.—I. K. Kikoin, I. Kh. Ganev & A. I. Karchevski. (*C. R. Acad. Sci. U.R.S.S.*, 1st Nov. 1954, Vol. 99, No. 1, p. 51. In Russian.) Further investigation of the new photomagnetic effect reported by Kikoin (3580 of 1954) shows that the observed e.m.f. is caused by a temperature gradient in the specimen. The direction of this e.m.f. depends on the direction of the magnetic field and on the magnetic nature (paramagnetic or diamagnetic) of the surrounding gas.

537.311.33 : 539.23 **1386**

Titanium Nitride and Titanium Carbide as Semiconductors.—A. Münster, K. Sagel & G. Schlamp. (*Nature, Lond.*, 18th Dec. 1954, Vol. 174, No. 4442, pp. 1154–1155.) Experiments are described with thin films of TiN deposited on Al_2O_3 and on SiO_2. The former exhibited metallic and the latter semiconductor properties. Examination of the structure of the films by X-ray diffraction indicated no difference between the two. Essentially the same behaviour was observed with TiC and with mixed crystals of TiN and TiC.

537.311.33 : 539.23 **1387**

Thin Semiconductor Films on Glass.—A. Fischer. (*Z. Naturf.*, June 1954, Vol. 9a, No. 6, pp. 508–511.) Oxide films having useful conducting properties combined with good transparency are obtained by depositing suitable metallic compounds on heated glass surfaces; Zn and In give particularly good results.

537.311.33 : [546.28 + 546.289 **1388**

Aging of Crushed Silicon and Germanium Crystals.—S. B. Brody. (*Acta cryst., Camb.*, 10th Nov. 1954, Vol. 7, Part 11, pp. 772–774.) Si and Ge have been investigated for the occurrence of time-dependent changes in the X-ray diagrams of freshly crushed crystals; Ge does not show these changes, Si does.

537.311.33 : [546.28 + 546.289 **1389**

Elastoresistance in *p*-Type Ge and Si.—E. N. Adams. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 803–804.) Formulae are derived for the energy states in the strained lattice and values are hence found for the three elastoresistance coefficients, referred to as piezoresistance coefficients by Smith (2418 of 1954).

537.311.33 : 546.28 **1390**

Hyperfine Splitting of Donor States in Silicon.—J. M. Luttinger & W. Kohn. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 802–803.) A theoretical estimate of the hyperfine splitting of phosphorus donor states is derived giving reasonable agreement with experimentally observed values [453 of February (Fletcher et al.)].

537.311.33 : 546.289 **1391**

Properties of Germanium Doped with Iron: Part 1 — Electrical Conductivity.—W. W. Tyler & H. H. Woodbury. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 874–882.) "Measurements of the temperature dependence of electrical resistivity in *p*- and *n*-type iron-doped germanium crystals indicate that Fe introduces impurity levels in Ge at 0·34 ± 0·02 eV from the valence band and 0·27 ± 0·02 eV from the conduction band. Such samples show very high resistivity at 77°K. At this temperature, *n*-type samples also show high photosensitivity and slow photoresponse, presumably because of hole traps."

537.311.33 : 546.289 **1392**

Properties of Germanium Doped with Iron: Part 2 — Photoconductivity.—R. Newman & W. W. Tyler. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 882–886.) Measurements were made on *n*-type and *p*-type specimens at a temperature of 77°K. The spectral distribution of the photoconductive response due to the impurity is the same in both types, indicating ionization energies of about 0·3 eV. For a given incident power, the intrinsic photoconductive response was 10–10^4 times greater for *n*-type than for *p*-type specimens; part of this difference is probably due to a difference of time constants, while the remainder may be due to differences in the numbers of active centres and in their transition probabilities. Quenching phenomena are discussed in relation to trapping effects.

537.311.33 : 546.289 **1393**

Germanium Technology: Part 1 — Preparation of the Germanium.—J. M. Mercier. (*Bull. Soc. franç. Élect.*, Nov. 1954, Vol. 4, No. 47, pp. 629–644.) Physical and chemical purification methods and the production of single crystals are described. See also 168 of January.

537.311.33 : 546.289 **1394**

Germanium Technology: Part 2 — Measurement of the Semiconductor Properties of Germanium.—

B. Pistoulet. (*Bull. Soc. franç. Élect.*, Nov. 1954, Vol. 4, No. 47, pp. 644–648.) A survey of methods for measuring resistivity and Hall coefficient. Part 1 : 1393 above.

537.311.33 : 546.289 **1395**

Statistics of the Occupation of Dislocation Acceptor Centres.—W. T. Read, Jr. (*Phil. Mag.*, Nov. 1954, Vol. 45, No. 370, pp. 1119–1128.) Continuation of work on dislocations in Ge reported previously (457 of February). Further approximations are developed taking account of nonuniform spacing of accepted electrons along the dislocation. The case where the dislocation acceptors have a range of energy levels rather than a single level is discussed. The various approximations are compared by plotting the fractions of filled acceptors against temperature for a particular dislocation in 1·7-Ω.cm *n*-type Ge.

537.311.33 : 546.289 **1396**

Influence of Free Charge Carriers in Germanium on the Absorption in the Near Infrared Region.—J. Jaumann & R. Kessler. (*Z. Naturf.*, May 1954, Vol. 9a, No. 5, p. 476.) Measurements were made on *p*- and *n*-type specimens over the temperature range corresponding to intrinsic conduction, up to 300°C; large reversible variations of the carrier concentration and optical absorption are obtained on varying the temperature. The absorption spectrum is structure free and indicates a value of 0·752 eV for the activation energy, in agreement with the value found from measurements of conductivity and Hall constant. Anomalously high absorption in the asymptotic part of the curve must be due to impurities, and affords a method of measuring impurities much more sensitive than electrical methods.

537.311.33 : 546.289 **1397**

The Effect of Special Lattice Imperfections on the Electrical Properties of Germanium.—K. Blank, D. Geist & K. Seiler. (*Z. Naturf.*, June 1954, Vol. 9a, No. 6, pp. 515–520.) An experimental investigation was made of the dependence of conductivity and carrier lifetime on imperfections such as individual misplaced atoms, dislocations and impurity centres. After 15 min heating at 800°C and cooling at the rate of 400 deg/s, a sample which was initially an intrinsic semiconductor at room temperature contained fewer than 10^{14} ionized acceptors or donors per cm^3 when impurities were excluded. A similar result was obtained with cooling at 40 deg/s combined with plastic deformation. Carrier lifetime was unaffected by simple heating, but was considerably reduced when plastic deformation was superimposed. With doped Ge similarly heated and cooled at 40 deg/s, fewer than 10^{15} acceptors and some 10^{14} donors per cm^3 were produced which were not ionized at room temperature.

537.311.33 : 546.289 **1398**

On the Relation between the Sum of Donor and Acceptor Concentration and Lifetime in Single Crystal Germanium.—P. Ransom & F. W. G. Rose. (*Proc. phys. Soc.*, 1st Aug. 1954, Vol. 67, No. 416B, pp. 646–650.) An approximate relation between the total impurity concentration, the activation energy of the traps, and the lifetime of minority carriers in *n*-type single-crystal Ge is derived. Lifetime measurements were made on samples of Sb-doped *n*-type Ge in the temperature range 242°K–302°K, and on undoped samples in the range 242°K–319°K. Values of total impurity concentration are computed from resistivity measurements at various temperatures, and computations of other quantities are made from the experimental data. These show that the approximations made are valid over a considerable range of temperatures. It therefore seems possible from resistivity measurements at various temperatures to determine directly the trap concentration and, in conjunction with lifetime measurements at room temperature, to differentiate between samples having different traps.

537.311.33 : 546.289 : 541.135 **1399**

Experiments on the Interface between Germanium and an Electrolyte.—W. H. Brattain & C. G. B. Garrett. (*Bell Syst. tech. J.*, Jan. 1955, Vol. 34, No. 1, pp. 129–176.) A report is presented of studies of Ge electrodes in contact with aqueous solutions of KOH, KCl and HCl, with anodic and cathodic currents. The anodic current, apart from a small leakage term, is determined by the flow of holes to the surface, so that saturation occurs for *n*-type but not for *p*-type material; the current gain is 1·4–1·8. The cathodic current is determined by the supply of electrons; the current gain is of the order of unity and the leakage term is larger than for anodic material. The effects of illumination are discussed. The results can be understood from simple thermodynamic considerations. See also 1698 of 1953 (Brattain & Bardeen) and 458 of February (Garrett & Brattain).

537.311.33 : 546.289 : 548.7 **1400**

Etching of Single Crystal Germanium Spheres.—R. C. Ellis, Jr. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1497–1499.) As a result of etching, the spheres were transformed into solid figures bounded by characteristic polyhedra. The only twins found were of (111)-plane type.

537.311.33 : 546.289 : 621.314.632 **1401**

Investigation of Change of Rectifying Properties of Metal-Semiconductor Point Contact under the Influence of Bombardment of Semiconductor by Alkali Metal Ions.—M. M. Bredov, R. F. Komarova & A. R. Regel'. (*C. R. Acad. Sci. U.R.S.S.*, 1st Nov. 1954, Vol. 99, No. 1, pp. 69–72. In Russian.) An experimental investigation is reported of the effect on an *n*-type-Ge/metal contact of bombardment by a monochromatic beam of K ions with energy in the range 1–4 keV and of the subsequent treatment of the surface. The observed decrease of the rectification property depends on the energy of the ion beam, but no effect was noticed when this was less than 1 keV. The treatment included polishing and immersion in a 30% solution of H_2O_2. Results are presented graphically and discussed.

537.311.33 : 546.472.21 **1402**

On the Properties of Single Cubic Zinc Sulfide Crystals.—S. J. Czyzak, D. C. Reynolds, R. C. Allen & C. C. Reynolds. (*J. opt. Soc. Amer.*, Nov. 1954, Vol. 44, No. 11, pp. 864–867.) Optical and electrical properties were measured for five crystals with impurity content $<$ 0·005%. Conductivity is largely intrinsic, and there is a rapid rise and decay of the small photocurrents obtained.

537.311.33 : 546.482.21 : 548.5 **1403**

Microscope Observations and Conductivity Measurements on CdS Crystals.—L. Herforth & J. Krumbiegel. (*Z. Naturf.*, May 1954, Vol. 9a, No. 5, pp. 432–434.)

537.311.33 : 546.482.21 : 548.5 **1404**

The Position of the Twinning Plane in Hexagonal CdS Crystals.—K. H. Jost. (*Z. Naturf.*, May 1954, Vol. 9a, No. 5, pp. 435–436a.)

537.311.33 : 546.621.86 **1405**

Electrical and Optical Properties of Intermetallic Compounds : Part 3—Aluminum Antimonide.—R. F. Blunt, H. P. R. Frederikse, J. H. Becker & W. R. Hosler. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 578–580.) "Measurements of resistivity, Hall coefficient, and optical absorption of AlSb are reported. The width of the forbidden energy band, derived from electrical and optical data, is 1·6 eV at absolute zero. Absorption bands are observed at 0·75 eV in p-type samples and at 0·31 eV in tellurium-doped n-type specimens. An energy level diagram with several acceptor and donor levels in the forbidden energy band is suggested to explain these observations."

537.311.33 : 546.681.86 **1406**

Electrical and Optical Properties of Intermetallic Compounds : Part 2 — Gallium Antimonide.—R. F. Blunt, W. R. Hosler & H. P. R. Frederikse. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 576–577.) "The Hall effect and resistivity of GaSb have been investigated over the temperature range 78° to 750°K. Hole mobilities as high as 400 $\mathrm{cm^2}$/volt-sec and a forbidden energy gap of 0·775 eV at absolute zero were found. Optical absorption studies at temperatures between 10° and 300°K confirm this value of the band separation."

537.311.33 : 546.682.86 **1407**

Electrical and Optical Properties of Intermetallic Compounds : Part 1 — Indium Antimonide.—R. G. Breckenbridge, R. F. Blunt, W. R. Hosler, H. P. R. Frederikse, J. H. Becker & W. Oshinsky. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 571–575.) Measurements of conductivity and Hall coefficient over the temperature range 78°–750°K are reported. Values deduced for charge-carrier mobility and effective mass are in good agreement with results of other workers. The value 0·23 eV is found for the width of the energy gap at 0°K. A study of the optical absorption at temperatures between 13° and 300°K shows that the position of the absorption edge of degenerate n-type samples depends on the impurity content and is in good agreement with Burstein's predictions (2134 of 1954).

537.311.33 : 546.682.86 **1408**

Electrical Properties of Indium Antimonide : Part 2.—O. Madelung & H. Weiss. (*Z. Naturf.*, June 1954, Vol. 9a, No. 6, pp. 527–534.) Careful measurements of Hall constant and conductivity are reported. The value of the energy gap at absolute temperature T is found to be $0{\cdot}27-3{\cdot}10^{-4}T$ eV. The electron mobility is about 65 000 $(T/300)^{-1{\cdot}66}$ cm/s per V/cm. The hole mobility is considerably lower and is strongly dependent on temperature. For previous work see 2707 of 1954 (Weiss).

537.311.33 : 546.72 **1409**

Some Electrical Properties of Natural Crystals of Iron Pyrite.—J. C. Marinace. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, p. 593.) Measurements of Hall coefficient and resistivity were made on p-type and n-type specimens cut from natural single crystals. A value about 1·2 eV is estimated for the width of the energy gap.

537.311.33 : 546.817.221 **1410**

Electrical Properties and the Solid-Vapor Equilibrium of Lead Sulfide.—R. F. Brebrick & W. W. Scanlon. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 598–602.) "Natural PbS crystals were exposed to various pressures of sulfur-vapor near 500°C and then quenched. Calculations based on the penetration of p-n junctions gave an interdiffusion constant of 2×10^{-6} $\mathrm{cm^2}$/sec at 550°C. The temperature dependence of the Hall coefficient and resistivity for several treated crystals was determined. A forbidden energy gap of 0·37 ± 0·01 eV and an electron to hole mobility ratio of 1·4 was obtained."

538.221 **1411**

Reversible Susceptibility of Ferromagnetics.—D. M. Grimes & D. W. Martin. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 889–896.) Formulae are developed for both transverse and parallel reversible susceptibilities. Measurements on ferrite cores are reported. The theoretical and experimental results show satisfactory agreement.

538.221 **1412**

Ferromagnetic Properties of Oxidized Mn_2Sb.—G. D. Adam & K. J. Standley. (*Proc. phys. Soc.*, 1st Nov. 1954, Vol. 67, No. 419A, pp. 1022–1023.) The formula Mn_2SbO is tentatively assigned to a material which has been prepared by heating finely powdered Mn_2Sb in air to temperatures between 200° and 350°C. Measurements of magnetization, Curie point, and microwave resonance absorption, as well as X-ray powder photographs, indicate that the material is quite distinct from Mn_2Sb.

538.221 **1413**

Magnetic Anisotropy Constants of Ferromagnetic Spinels.—R. S. Weisz. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 800–801.)

538.221 **1414**

Ferromagnetic Resonance in Iron-Nickel Alloys.—R. Hoskins & G. Wiener. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 1153–1154.) Experiments were made with disk-shaped bulk specimens to verify the results obtained by Bagguley (443 of 1954) with suspensions of ferromagnetic particles. No evidence was found of a variation of g value with Ni concentration.

538.221 **1415**

Measurement of the Complex Tensor Permeability of Ferrites.—J. H. Rowen & W. von Aulock. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 1151–1153.) Disadvantages of the cavity-resonator method described by Artman & Tannenwald (769 of 1954) are removed by using a disk in place of a spherical sample.

538.221 : 538.652 **1416**

Rapid Method of evaluating Magnetostrictive Materials for Electromechanical Transducers.—M. T. Pigott & P. M. Kendig. (*J. acoust. Soc. Amer.*, Nov. 1954, Vol. 26, No. 6, pp. 974–976.) Methods described by van der Burgt (3624 of 1953) are adapted for investigating metal laminations as well as ferrites.

538.221 : 546.73 **1417**

Magnetic Powder-Patterns on Cobalt and the Structure of the Elementary Domains.—W. Andrä. (*Ann. Phys., Lpz.*, 15th Nov. 1954, Vol. 15, No. 2, pp. 135–140.) Powder patterns, photographs of which are shown, are interpreted to give an indication of the structure in depth of the magnetic domains.

538.221 : 621.318.134 **1418**

Investigation of Magnetic Properties of Co-Zn and Mn-Zn Ferrites.—G. I. Dmitrakova. (*C. R. Acad. Sci. U.R.S.S.*, 1st Nov. 1954, Vol. 99, No. 1, pp. 45–46. In Russian.) Graphs are presented showing the variation of magnetic moment and Curie point of the ferrites with the ZnO content, the temperature dependence of magnetization and the reciprocal susceptibility. The results are briefly discussed on the basis of Néel's theory (1171 of 1950).

621.3 **1419**

Materials used in Radio and Electronic Engineering.—(*J. Brit. Instn Radio Engrs*, Jan. 1955, Vol. 15, No. 1, pp. 47–64.) This first part of a survey of the materials most commonly used in electronic equipment deals with (*a*) aluminium and its alloys, and (*b*) piezoelectric crystals.

621.315.612.4 **1420**

Low-Temperature Sintering of Titanium Dioxide for Ceramic Capacitors.—T. V. Ramamurti, C. V. Ganapathy & S. Saran. (*Nature, Lond.*, 25th Dec. 1954, Vol. 174, No. 4443, p. 1187.) Experiments made at the National Physical Laboratory of India have resulted in the production of ceramic bodies with a typical permittivity value of 110 when fired at temperatures as low as 1100°C. The raw material was of rutile form, in a finely divided active state.

621.315.616 **1421**

Transition Temperature of Polymethyl Methacrylate at Ultrasonic Frequencies.—P. Hatfield. (*Nature, Lond.*, 25th Dec. 1954, Vol. 174, No. 4443, pp. 1186–1187.) Results of measurements by various workers of the temperature variation of the velocity of ultrasonic waves in perspex are shown graphically and discussed. Ultrasonic frequencies up to 11 Mc/s were used.

MATHEMATICS

517 **1422**

Symmetric Linear Transformations and Complex Quadratic Forms.—C. L. Dolph, J. E. McLaughlin & I. Marx. (*Commun. pure appl. Math.*, Nov. 1954, Vol. 7, No. 4, pp. 621–632.) Discussion of application of the Rayleigh-Ritz method as an approximation procedure for investigating characteristic values and characteristic functions occurring in the theory of wave propagation.

517.562 **1423**

Locus Diagrams of some Elementary Transcendental Functions.—H. Wahl. (*Frequenz*, Nov. 1954, Vol. 8, No. 11, pp. 346–351.) The functions considered are e^{pA}, and sin pA, where p is a real parameter and A is a constant which may be complex. The form of the curve, distribution of the parameters, special points on the curve, tangent and radius vectors, and the construction of the curves are briefly discussed.

MEASUREMENTS AND TEST GEAR

621.3.018.41 (083.74) + 621.396.91 **1424**

C.C.I.R. Study Commission No. VII : Organization of World-Wide Standard-Frequency and Time-Signal Service as Task of C.C.I.R.—U. Mohr. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 596–598.) Important points from the report presented at the 1953 plenary session of the C.C.I.R. are summarized. It is suggested that reports in preparation regarding the derivations and corrections of standard-frequency transmissions should be directly exchanged between interested stations. Possible improvements in the nature of time signals are indicated. Plans for a service within Western Germany are outlined ; this would operate from a Post Office transmitter at Mainflingen (call sign DCF77) on a frequency of 77·5 kc/s constant to within 1 part in 10^8.

621.3.018.41(083.74) **1425**

World-wide Frequency and Time Comparisons by means of Radio Transmissions.—J. A. Pierce, H. T. Mitchell & L. Essen. (*Nature, Lond.*, 13th Nov. 1954, Vol. 174, No. 4437, p. 922.) Results obtained at the National Physical Laboratory show that the standard frequency transmission MSF on 60 kc/s can be used in the United Kingdom with an accuracy of ± 1 part in 10^9 in an observation time of a few minutes; it has also been received and measured at Harvard with the same accuracy in a time of about 10 minutes. A typical photographic record taken at Harvard shows variations due to changes in the height of the reflecting ionosphere layers.

621.3.018.41 (083.74) : 621.373.421 **1426**

High-Stability One-Mc/s Frequency Standard.—(*Tech. News Bull. nat. Bur. Stand.*, Nov. 1954, Vol. 38, No. 11, pp. 162–163.) Portable equipment developed at the N.B.S. to serve as a secondary standard for general laboratory and field use comprises a crystal-controlled Meacham-bridge oscillator.

621.3.087.9 : 621-52 : 621.394.625.2 **1427**

Automatic Recording and Analysis of Data using Teleprinter Technique.—Nettell. (See 1456.)

621.314.7.001.4 **1428**

A Versatile Transistor Tester.—R. Bailey. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 64–69.) Equipment is described by means of which the characteristics of *p-n-p* or *n-p-n* transistors can be displayed as families of curves on the screen of a c.r.o. accurate to within about 10%. Facilities for point-by-point plotting with greater accuracy are incorporated.

621.317.3 : 621.317.723 **1429**

The Measurement of Voltage, Current, Power and Impedance at High Frequencies.—D. Karo. (*Beama J.*, Nov. 1954, Vol. 62, No. 1, pp. 33–35.) An electrometer is used with the four plates not connected in pairs, so that it forms a double electrometer with moving vane. Input resistance is $\sim$ 35 MΩ at 1 Mc/s and input capacitance $\sim$ 3 pF. Asymmetry and contact potential effects are eliminated either by calibrating one pair of plates against the other, or by using an electrometer with three pairs of plates. The method of use for each type of measurement and some of the forms the instrument may take are explained.

621.317.3 : 621.375.3 **1430**

Magnetic Amplifiers and Weak Currents.—R. Klein. (*Bull. Soc. franç. Élect.*, Nov. 1954, Vol. 4, No. 47, pp. 649–674.) Particular attention is devoted to the use of magnetic amplifiers for measurement purposes.

621.317.3 : 621.396.11.029.65 **1431**

Experimental Equipment and Techniques for a Study of Millimetre-Wave Propagation.—Willshaw, Lamont & Hickin. (See 1476.)

621.317.318 : 621.385.3 **1432**

The Application of the Electrometer Valve to Charge Measurements.—M. J. Morant. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, pp. 391–395.)

621.317.33 **1433**

Point Source and Sink in a Parallelepiped.—A. C. Sim & L. Lewin. (*Nature, Lond.*, 18th Dec. 1954, Vol. 174, No. 4442, p. 1155.) Analysis is presented relevant to the evaluation of the conductivity of semiconductors from measurements by the four-probe method.

621.317.337 **1434**

The Correction of *Q* Meter Readings.—M. V. Callendar : J. P. Newsome. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, p. 92.) Comment on 3622 of 1954 and author's reply.

621.317.361 : 519.2 **1435**

Application of Statistical Theory to the Measurement of Frequency.—H. Tanaka, G. Taguchi & M. Ota. (*Rep. elect. Commun. Lab., Japan*, Aug. 1954, Vol. 2, No. 8, pp. 9–14.) Frequency deviations of radio s.w. transmissions are considered. A method is developed for obtaining an unbiased estimate without assuming a normal distribution of the variation of oscillator frequency or of the error in the measurement equipment. This is applied in analysing the results of measurements made on eight frequencies at three places simultaneously over a period of four days, to obtain probable values for the frequency stability of the transmissions and the accuracy of the measurement equipment.

621.317.39 : 537.228.1 **1436**

New Sensitive Piezoelectric Detector.—R. Pepinsky, J. Baecklund, H. Diamant & W. G. Perdok. (*Rev. sci. Instrum.*, Nov. 1954, Vol. 25, No. 11, pp. 1076–1078.) An instrument using the frequency-sweep technique of Perdok & van Suchtelen (1966 of 1950) is described.

621.317.7 : 621.372.8 **1437**

Waveguides and Waveguide Junctions.—Dukes. (See 1255.)

621.317.7.001.4 **1438**

Test Methods and Construction of Shock-Proof [electrical] **Measurement Instruments.**—A. von Weiss. (*Bull. schweiz. elektrotech. Ver.*, 13th Nov. 1954, Vol. 45, No. 23, pp. 972–977.) Usual test methods, such as subjection to acceleration, vibration, or shock, are compared and their practical value is discussed. New shock-proof constructions using pivot and strip suspension systems are described.

621.317.715 **1439**

Rapid-Oscillation Galvanometers: Part 1—Fundamental Theory.—K. H. Winterling. (*Arch. tech. Messen*, Nov. 1954, No. 226, pp. 259–262.) Galvanometers with oscillation period < 1 sec are considered; these are used mainly as recording instruments. Frequency characteristics and delay times, optimum damping and power requirements are discussed.

621.317.715 **1440**

The Response of String Galvanometers with Heavy Electromagnetic Damping.—D. A. Senior. (*Instrum. Practice*, Nov. 1954, Vol. 8, No. 11, pp. 968–974.)

621.317.729 : 621.385.032.2 **1441**

Use of a Rubber Sheet Model for Investigation of Electron Trajectories.—K. R. Allen & K. Phillips. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 82–85.) Experiments are reported which indicate that the rubber-sheet model can be used satisfactorily in the design of electron guns. A novel method of obtaining equipotentials is described.

621.317.73 **1442**

Direct-Reading Capacitance Tester.—O. E. Dzierzynski. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 141–143.) The instrument described covers the range 10 pF–1 mF. The basic circuit comprises a 50-c/s source driving current through the capacitance in series with a resistance of magnitude such that the current is proportional to the capacitance. The voltage across the resistance is amplified and rectified to give direct readings on a milliammeter.

621.317.73.029.55/.62 **1443**

Theory of the Reflectometer.—H. Wolf. (*Arch. elekt. Übertragung*, Nov. 1954, Vol. 8, No. 11, pp. 505–512.) Reflectometers comprising an auxiliary line arranged parallel to a main transmission line [477 of 1953 (Grosskopf)] are discussed. Differential equations are established from which voltage and current distributions are calculated. Approximate formulae are presented for the case of loose coupling. A numerical example is given.

621.317.755 **1444**

A Sensitive Continuously-Evacuated Cathode-Ray Oscillograph.—L. J. Griffiths, R. M. Davies & D. A. Richards. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 48–52.) An instrument for recording nonrecurrent transients with peak values not exceeding 100 mV and durations up to 100 μs is described. The record is produced by direct action of the electron beam on a photographic emulsion, giving greater photographic sensitivity and lower distortion than when the trace is photographed from a luminescent screen. The apparatus has been used for measurements of stress waves in solids.

621.317.755 **1445**

A Portable High-Speed Cathode-Ray Oscillograph.—L. S. Allard. (*J. sci. Instrum.*, Nov. 1954, Vol. 31, No. 11, p. 433.) Note on precautions required to safeguard the c.r. tube in the oscillograph described by Waring & Murphy (1862 of 1954).

621.317.772 **1446**

Direct-Indicating Phase Meter for 50 c/s to 100 kc/s.—H. Haller. (*Frequenz*, Nov. 1954, Vol. 8, No. 11, pp. 325–333.) Rectangular waves derived from the signals under examination are applied to separate grids of a valve which conducts only when the two are of the same sign. The average anode current is then a function of their phase difference. A complete circuit diagram is given and briefly described. 26 references to other phase indicators and comparators are also given and the various principles of operation are classified.

621.317.78 **1447**

A Very-Wide-Band Dummy Load for measuring Power at Very-High and Ultra-High Frequencies.—W. Hersch. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 96–98.) A dummy load is described consisting of a short coaxial line filled with carbon tetrachloride, the inner conductor being built up from short sections of thin gold-film resistors in which nearly all the power loss occurs. Its input impedance, of 75 Ω, is purely resistive, and it permits measurement of power from 10 W to 1 kW accurate to within ± (2½% of measured power + 3 W) at frequencies over 100 Mc/s.

621.318.4(083.74) **1448**

A Study of Absolute Standards of Mutual Inductance and in particular the Three-Section National Bureau of Standards Type.—F. W. Grover. (*J. Res. nat. Bur. Stand.*, Nov. 1954, Vol. 53, No. 5, pp. 297–320.) "The results of a study of the number and location of the circles of zero field surrounding a multisection coil are presented. The configuration of the field surrounding the equatorial region of several three-section coils has been partially mapped out. One arrangement yields a design in which the mutual-inductance contribution of any secondary turn differs but little from that of the median turn. By locating the secondary symmetrically about the circles of zero field, the correction for winding distribution can be made small, and the effect of uncertainties in location of individual secondary turns minimized."

621.373.421 **1449**

The Bridge-Stabilized Oscillator as Standard Source of A.C. Voltage.—G. Hoffmann. (*Arch. tech. Messen*, Nov. 1954, No. 226, pp. 263–266.) Methods of stabilizing the oscillation amplitude by means of barretter bridges are indicated, and applications of the circuit as a calibration source and as a standard-level source are described.

621.397.5 : 535.623].001.4 **1450**

Phase Meter analyzes Color TV Systems.—Houghton. (See 1495.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.1-8 : 621.9 **1451**

Ultrasonic Machining.—(*Trans. Inst. Radio Engrs*, Nov. 1954, No. PGUE-2, pp. 9–33.) The following three papers are given :—

- An Ultrasonic Machine Tool (pp. 10–18).—N. Clark, Jr.
- Ultrasonic Machining of Tungsten Carbide (pp. 19–22).—D. Goetze.
- Mechanical Impedance Transformers in relation to Ultrasonic Machining (pp. 23–33).—L. Balamuth.

534.2-8 : 620.179.1 **1452**

How to check Accuracy of Ultrasonic Flaw Detection.—N. Grossman. (*Mater.& Meth.*, Nov. 1954, Vol. 40, No. 5, pp. 100–101.) Reference blocks machined from regular production materials are used to provide a simple method of setting the equipment to detect flaws above a specified minimum size.

535.4 : 537.533 **1453**

An Electron Interferometer.—L. Marton, J. A. Simpson & J. A. Suddeth. (*Rev. sci. Instrum.*, Nov. 1954, Vol. 25, No. 11, pp. 1099–1104.) The instrument described makes use of crystalline diffraction for beam splitting and recombining.

535.4 : 537.533 **1454**

The Theory of the Three-Crystal Electron Interferometer.—J. A. Simpson. (*Rev. sci. Instrum.*, Nov. 1954, Vol. 25, No. 11, pp. 1105–1109.)

621.3 : 621.791 **1455**

Electronic Control of Resistance Welding.—C. R. Bates. (*J. Brit. Instn Radio Engrs*, Jan. 1955, Vol. 15, No. 1, pp. 31–46. Discussion, p. 46.) Basic circuits of timing and sequence controls are described and the principles of operation of complete control units are indicated.

621.3.087.9 : 621-52 : 621.394.625.2 **1456**

Automatic Recording and Analysis of Data using Teleprinter Technique.—D. F. Nettell. (*Instrum. Practice*, Nov. & Dec. 1954, Vol. 8, Nos. 11 & 12, pp. 975–980 & 1078–1082.) The principles and the advantages of the punched-type system in continuous recording and processing of data are discussed and examples of applications in production-control are given.

621.37/.38 : 531.383 **1457**

A Precision Dynamic Balancer (for Small Gyroscopes).—D. Williamson. (*Electronic Engng*, Feb. 1955, Vol. 27, No. 324, pp. 53–59.)

621.384.613 **1458**

Experimental Studies of Betatron Orbit Stability.—G. C. Baldwin, F. R. Elder & W. F. Westendorp. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1553–1554.)

621.384.622 **1459**

Strong Focusing in Linear Accelerators for Ions.—M. Y. Bernard. (*Ann. Phys., Paris*, Nov./Dec. 1954, Vol. 9, pp. 633–682.) The theory of the motion of heavy particles in a linear accelerator, and the strong-focusing principle, are examined in detail. Theoretical and experimental work is reported on the design of lenses for strong-focusing devices, both electrostatic and magnetic types being practicable.

621.385.833 **1460**

Some Properties of Symmetrical Slit ('Cylindrical') Electron Lenses.—G. D. Archard. (*Brit. J. appl. Phys.*, Nov. 1954, Vol. 5, No. 11, pp. 395–399.) "The focal lengths of a series of symmetrical slit ('cylindrical') electrostatic electron lenses are determined as a function of aperture size and applied potential. It is shown that all practical lenses may be represented on a single curve by means of a parameter simply related to potential and geometry. From this it is deduced that lens strength depends more on the size of the central aperture than on that of the outer apertures."

621.387.424 **1461**

Time-Delay Distribution in Geiger-Müller Counters.—E. Picard & A. Rogozinski. (*J. Phys. Radium*, Nov. 1954, Vol. 15, No. 11, pp. 767–775.) Statistical analysis of results of delay measurements shows that to minimize the response-time delay and make it largely independent of the sensitivity of the associated amplifier the counter should have as small a diameter and as high an applied voltage as possible.

621.387.424 **1462**

The Ionic Multiplication Coefficient in CO_2-Filled Counters.—R. Fourage & L. Miramond. (*J. Phys. Radium*, Nov. 1954, Vol. 15, No. 11, pp. 780–781.)

621.387.424 **1463**

Influence of the Limited Proportionality Region on the Value of the Geiger Threshold of Counters with Externally Graphited Glass Cylinders.—D. Blanc. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1621–1622.)

621.387.464 **1464**

The Scintillation Counter in Industry with Reference to Stability Problems.—J. S. Eppstein. (*J. Brit. Instn Radio Engrs*, Jan. 1955, Vol. 15, No. 1, pp. 25–29.) A circuit is described for minimizing the effects of changes of photomultiplier gain.

621.56 : 537.311.33 : 537.322.1 **1465**

The Use of Semiconductors in Thermoelectric Refrigeration.—H. J. Goldsmid & R. W. Douglas. (*Brit. J. appl. Phys.*, Nov. 1954, Vol. 5, No. 11, pp. 386–390.) Factors governing the selection of suitable semiconductors are discussed. The material should have a high atomic weight and the thermoelectric power should lie between 200 and 300 μV per °C. Calculations show that the maximum cooling obtainable with an n-type-Ge/metal junction is about 2°C, but that cooling of as much as 28°C should be obtainable with a p-type-Bi_2Te_3/Bi junction; cooling of 26°C was actually obtained using elements of length 1 cm and respective cross-sections of 0·25 cm^2 and 0·03 cm^2, with a current of 6·5 A. The calculated figure of merit was 0·475. The possible application of the inverse effect in solar-energy thermoelectric generators is mentioned.

PROPAGATION OF WAVES

538.566 **1466**

Reflection of Waves by an Inhomogeneous Medium.—V. A. Bailey. (*Phys. Rev.*, 15th Nov. 1954, Vol. 96, No. 4, pp. 865–868.) New approximations are proposed which give good agreement with the known fundamental pair of solutions for the general second-order differential equation of propagation, but which remain finite. A corresponding approximate expression is derived for the coefficient of reflection of plane waves by a specified inhomogeneous medium; by means of an iterative process, a sequence of approximations is developed which converge rapidly on the true value.

538.566 : 535.312 **1467**

Statistics of Electromagnetic Radiation Scattered by a Turbulent Medium.—R. A. Silverman & M. Balser. (*Phys. Rev.*, 1st Nov. 1954, Vol. 96, No. 3, pp. 560–563.) "The theory of Villars & Weisskopf [2747 of 1954] is used to calculate the univariate and bivariate amplitude distributions of electromagnetic radiation scattered from turbulent fluctuations. The univariate distribution is Rayleigh, and is in excellent agreement with measurements made on a 49·6-Mc/s ionospheric scatter link. Using the bivariate distribution, we relate the amplitude correlation function to a velocity correlation function which appears in the von Weizsäcker-Heisenberg statistical theory of turbulence. In this way the theoretical velocity correlation can be compared with experiment."

538.566 : 535.42 **1468**

Diffraction of Electromagnetic Waves at Non-ideally Conducting Wedge and Problem of Coastal Refraction.—V. A. Il'in. (*C. R. Acad. Sci. U.R.S.S.*, 1st Nov. 1954, Vol. 99, No. 1, pp. 47–50. In Russian.) Results are given of the theoretical consideration of four cases: (*a*) diffraction of e.m. waves from point or line source, (*b*) an alternative method for (*a*) for the particular case when the wedge angle is an integral submultiple of π, (*c*) diffraction of a plane wave, and (*d*) coastal diffraction. The solutions are obtained by modification of the known solutions for an ideally conducting wedge as in 17 of January. In case (*d*) the conductivity is assumed to vary continuously at the sea-land boundary; for waves with the electric field perpendicular to the coast line the signal strength should increase towards the coast line, for the magnetic field perpendicular to the coast line it decreases.

621.396.11 : 551.510.535 **1469**

Simultaneous Ionospheric Absorption Measurements at Widely Separated Stations.—W. J. G. Beynon & K. Davies. (*J. atmos. terr. Phys.*, Nov. 1954, Vol. 5, Nos. 5/6, pp. 273–289.) Noon vertical-incidence measurements for the period September 1950–August 1951, made at Slough and Swansea (230 km apart), are compared. The frequency used was 2 Mc/s. The average correlation coefficient is 0·85 for winter months and 0·81 for summer months. Oblique-incidence intensity measurements were also made on c.w. signals of equivalent frequencies from Skelton, about 366 km north of Swansea, and from Allouis, about 666 km south-east of Swansea. The observations give some indication of the progressive decrease in the degree of correlation with increasing distance between stations. The use of simple field-strength recording as a measure of the absorption is briefly considered.

621.396.11 : 551.510.535 **1470**

The Physics of the Ionosphere.—(See 1340.)

621.396.11 : 551.594.5 **1471**

Polarization of Radio Echoes from Aurorae.—A. G. McNamara & B. W. Currie. (*Nature, Lond.*, 18th Dec. 1954, Vol. 174, No. 4442, pp. 1153–1154.) Observations made at Saskatoon are described and the results analysed. Frequencies of 56 and 106·5 Mc/s were used. Horizontally polarized signals were transmitted towards magnetic north, and a multiple aerial system was used to determine the angle of arrival and the different types of polarization of the echoes. A histogram shows numbers of echoes for different values of polarization ratio (ratio of horizontal to vertical component of field strength). A wide variation of this ratio was observed on 56 Mc/s; on 106·5 Mc/s all the echoes were polarized in the same plane as the transmitted signals. Multiple scatter within the reflecting region is considered more likely than magneto-ionic effect to cause depolarization.

621.396.11 : 551.594.6 **1472**

The Wave-Forms of the Electric Field in Atmospherics recorded simultaneously by Two Distant Stations.—Norinder. (See 1348.)

621.396.11.029.6 **1473**

Review of Long-Distance Radio-Wave Propagation above 30 Mc/s.—W. J. Bray, H. G. Hopkins, F. A. Kitchen & J. A. Saxton. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 87–95.) Factors affecting normal propagation are reviewed. Surface roughness modifies the structure of the refractive-index profile. Diffraction effects produced by single large obstacles and by groups of obstacles are indicated. Attenuation due to absorption by oxygen and water vapour, and to absorption and scattering by clouds, fog and precipitation, become significant at frequencies over 3 kMc/s. Ionospheric propagation via the F_2 layer, via the E_s layer, by scattering from the E layer and via the aurorae, and tropospheric propagation by way of elevated inversions, under conditions of superrefraction near the earth's surface, and by way of scattering from atmospheric turbulence, are discussed briefly. 61 references.

621.396.11.029.62 **1474**

Some Features of V.H.F. Tropospheric Propagation.—M. W. Gough. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 43–58.) An analysis is made of continuous v.h.f. signal-strength records over numerous and diverse paths in tropical and Mediterranean regions; the observed variations can be satisfactorily explained in terms of well-known tropospheric states. In some cases it is possible to reconstruct from the records the salient features of tropospheric *M* profiles operative during the tests. Prolonged measurements over a Mediterranean path have yielded statistics of variations of the effective earth-radius factor which should be useful for predicting the statistical behaviour of other paths in that area. A limited connection is found between median path attenuation and fading range for paths experiencing comparable tropospheric influences; on this basis the statistical behaviour of paths can be forecast approximately without a preliminary radio survey.

621.396.11.029.62/.63 : 551.509 **1475**

Propagation on 144 and 420 Mc/s.—C. E. Newton, G. M. C. Stone, A. J. Worrall & H. W. Parker. (*R.S.G.B. Bull.*, Nov. 1954, Vol. 30, No. 5, pp. 210–215.) A simple introduction is given to the interpretation of meteorological conditions for forecasting anomalous propagation, with particular reference to the London region.

621.396.11.029.65 : 621.317.3 **1476**

Experimental Equipment and Techniques for a Study of Millimetre-Wave Propagation.—W. E. Willshaw, H. R. L. Lamont & E. M. Hickin. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 99–111.) Report of a programme of research, carried out between 1945 and 1949, on propagation at wavelengths of 4–6 mm. Crystal harmonic generators and pulse and c.w. magnetrons were used as generators; the design of crystal detectors and mixers is discussed. Measurements were made of attenuation due to oxygen absorption over paths of a few kilometres; values of the reflection coefficient of the sea surface were derived.

RECEPTION

621.376.232.2.018.75 **1477**

Pulse Response of Signal Rectifiers.—W. B. Lewis. (*Wireless Engr*, March 1955, Vol. 32, No. 3, p. 89.) Comment on 849 of March (Callendar), referring to previously published partial solutions of some of the problems discussed (*ibid.*, Sept. 1932, Vol. 9, No. 108, pp. 487–499).

621.396.62 : 621.314.63 **1478**

Influence of Image Frequency in Microwave Receivers with [crystal] **Detector Mixer.**—E. Willwacher. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 608–615.) Conversion loss and i.f. output admittance are considered; analysis is presented indicating how the terminating admittance for the image frequency should be taken into account in the design of the receiver. A numerical example is given. Experiments with a receiver for the frequency range 2·1–2·3 kMc/s emphasize the importance of providing a line of suitable length between the input filter and the mixing circuit in order to keep the noise factor constant.

621.396.62 : 621.314.7 **1479**

Transistor Radio Receiver.—D. Nappin. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 123–124.) Details are given of a four-stage receiver with r.f. amplifier and push-pull output, using five point-contact transistors of which only that in the r.f. stage needs to be specially selected for a particular characteristic. The output is about 50 mW.

621.396.62.029.62 : 621.314.7 **1480**

A Transistor Superregenerative Receiver for 10 and 6 Meters.—W. A. Wadsworth. (*QST*, Nov. 1954, Vol. 38, No. 11, pp. 17, 134.) A two-transistor receiver is briefly described. The total power requirement of 0·06 W is provided by two 7·5-V batteries.

621.396.621 : 621.396.822 **1481**

Recovering Hidden Signals.—J. Franklin. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 137–140.) An outline is given of the use of correlation techniques, especially in relation to the detection of periodic signal components masked by random variations.

621.396.621.54 **1482**

Two-Valve Superhet.—R. C. Lever. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 145–146.) The circuit uses a Type-12AH8 triode-heptode as frequency changer and a Type-ECL80 triode pentode as detector and a.f. amplifier. The conventional i.f. amplifier is omitted, and the required gain is provided by regeneration.

621.396.621.54 **1483**

The TLR 190 : a Novel 4-Valve Superheterodyne Receiver.—J. Marsac. (*Toute la Radio*, Nov. 1954, No. 190, pp. 387–391.) Good sensitivity, selectivity and fidelity together with simplicity are claimed for a receiver using a high-slope i.f. amplifier with a cathode-loaded detector which is capable of producing an a.v.c. voltage for application to the i.f. suppressor grid.

621.396.621.54 : 621.314.7 **1484**

The Transistor as a Mixer.—P. D. Strum: J. Zawels. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, p. 230.) Comment on 1898 of 1954 and author's reply.

621.396.812.3 **1485**

Performance of Space and Frequency Diversity Receiving Systems.—R. E. Lacy, M. Acker & J. L. Glaser. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1954, Vol. 15, No. 12, pp. 313–317; *Convention Record Inst. Radio Engrs*, 1953, Part 2, pp. 148–152.) Report of an investigation covering a period of four years, carried out over three different paths. Six different frequencies were used, in the range 2·63–22 Mc/s. With the space-diversity systems, little improvement was obtained on increasing aerial separation beyond about 600 ft. Differences are indicated between the results for separation perpendicular to and parallel to the direction of propagation. The improvement in reception varied inversely as the frequency. With a dual frequency-diversity system operating at 11·66 Mc/s nominal, the improvement was only slightly less than with a dual space-diversity system with 600-ft separation.

STATIONS AND COMMUNICATION SYSTEMS

534.861 **1486**

Radio Studios.—W. Furrer. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Nov. 1954, Vol. 32, No. 11, pp. 430–436. In German.) A brief review of the requirements as regards electroacoustic equipment and acoustic characteristics, with illustrations of studio details.

621.39.001.11 **1487**

Information Theory and Knowledge.—A. Gamba. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, p. 1549.) Comment on 3032 of 1954 (MacDonald).

621.39.001.11 **1488**

Quantity of Information in a Gaussian Stationary Process contained in a Second Process Stationarily Connected with it.—M. S. Pinsker. (*C. R. Acad. Sci. U.R.S.S.*, 11th Nov. 1954, Vol. 99, No. 2, pp. 213–216. In Russian.) Formulae are derived for determining the entropy and quantity of information in a Gaussian stationary process, when the spectral functions are known. See also 3105 of 1951 (Elias).

621.396.44 : 621.395.82 **1489**

The Influence of Radio Transmissions on Carrier-Frequency Telephony on High-Voltage Lines.—J. Grosskopf. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 623–636.) An extensive experimental investigation was made of the interference effect of communication and broadcast transmissions in the frequency range 100 kc/s–1·5 Mc/s, both by direct measurement of the interference voltage and by estimating it from the strength of the local r.f. field. The interference voltages measured at the carrier-frequency input at the telephony stations were analysed statistically and related to the distance from the interfering transmitters and the position of the h.v. lines.

621.396.712(494) **1490**

Extension of the Swiss National Broadcasting Station at Sottens.—R. Pièce. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Nov. 1954, Vol. 32, No. 11, pp. 409–430. In French.) A short historical account is given of the development of the Sottens station, followed by a detailed description of equipment installed in 1951. The existing 100-kW transmitter has been supplemented by two 100-kW units which can be operated in parallel or independently, thus avoiding a break in transmission if one of the units fails.

SUBSIDIARY APPARATUS

621.316.722.1 : 621.387 **1491**

The Processing and some Characteristics of Coaxial Cylinder, Corona Stabilizer Tubes.—A. J. L. Collinson & D. W. Hill. (*J. sci. Instrum.*, Jan. 1955, Vol. 32, No. 1, pp. 13–17.) The running voltage of tubes filled with hydrogen has been found to be stable to within 0·02% over 24 h and to within 1% over 1 000 h. The dependence of slope resistance on pressure and current has been investigated. The temperature coefficient of running voltage is about +0·005% per deg C. It may be possible to obtain higher current by glow discharge treatment.

621.319.3 **1492**

A New Type of High-Voltage Machine.—R. E. D. Clark & F. T. Farmer. (*Nature, Lond.*, 4th Dec. 1954, Vol. 174, No. 4440, pp. 1065–1066.) A machine is described which operates on a principle related to that of the van de Graaff generator, with the difference that the moving belts carry not surface charges but capacitors which become charged on reaching a certain point and are then connected in series. Performance figures are given for an experimental model in which the capacitors are stationary and the electrical contacts are rotated.

TELEVISION AND PHOTOTELEGRAPHY

621.397.242 : 621.376.2 **1493**

Modulators and Demodulators for the Transmission of Television Pictures via Cables.—W. Dillenburger. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 589–596.) German practice, where the distance between studio and transmitter is several kilometres, is to transmit the picture signal on a 21-Mc/s carrier. Systems with the modulation applied to the control grid are preferred to those with the modulation on the suppressor grid. Automatic control of the synchronizing-pulse level at the demodulator output is necessary; the simplest method is to subject the synchronizing pulses to enhanced amplification followed by limiting. A magnetic voltage stabilizer is included in the valve-heater circuit. A simple black-level-setting arrangement including a keyed diode is used.

621.397.5 **1494**

Special Television Numbers.—(*Onde élect.*, Nov. & Dec. 1954, Vol. 34, Nos. 332 & 333, pp. 824–945 & 958–1040.) Papers are included on numerous aspects of the subject, including the physiological optics of viewing, a spiral scanning system, transmitting-station equipment, the 'cigar type' and related types of aerial for long-distance reception on metre wavelengths, asymmetrical-sideband transmission systems, European programme-exchange arrangements, outside-broadcast equipment, cm-λ link equipment, large-screen projection systems, telecine and telerecording equipment, and industrial television equipment.

621.397.5 : 535.623].001.4 **1495**

Phase Meter analyzes Color TV Systems.—R. W. Houghton. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 156–160.) The phase specifications for the N.T.S.C. system are discussed. To ensure that there is no perceptible colour error, receiver phase errors must be below 5°, corresponding to a time delay of 0·004 μs at the colour subcarrier frequency of 3·58 Mc/s. Test equipment suitable for use in receiver factory or broadcast studio is described.

621.397.5 : 778.5 **1496**

The Recording, Reproduction and Processing of Sound Films for Television.—H. Friess. (*Fernmeldetech. Z.*, July 1954, Vol. 7, No. 7, pp. 346–348.)

621.397.5(083.74)(94) **1497**

Australian Television. Revision of Technical Standards.—(*Proc. Instn Radio Engrs, Aust.*, Dec. 1954, Vol. 15, No. 12, pp. 318–320.) The revised standards issued on 1st October 1954 are presented.

621.397.5(083.74)(94) **1498**

Technical Requirements of the Australian Television System.—A. J. McKenzie. (*Proc. Instn Radio Engrs, Aust.*, Dec. 1954, Vol. 15, No. 12, pp. 301–312.) A table is presented of the television standards of various countries, including those for the projected Australian system. The latter are discussed in detail; they differ only slightly from the C.C.I.R. 625-line standards, the most important difference being that a channel width of 7·5 Mc/s is specified as compared with the C.C.I.R. 7 Mc/s; this is largely with a view to the later introduction of colour television. Receiver i.f.s of 31·25 Mc/s and 37·25 Mc/s for sound and picture respectively are recommended. Frequency details are given of v.h.f. and u.h.f. channel reservations. It is estimated that an allocation of three stations to each capital city and one to each town with a population over 5 000 is reasonable, subject to economic considerations.

621.397.6 **1499**

Industrial Television Equipment using Spiral Scanning.—A. V. J. Martin. (*Toute la Radio*, Nov. 1954, No. 190, pp. 357–363.) Description of equipment developed by Derveaux, in which the scanning waveform is a 15-kc/s sine wave modulated with a 50-c/s sawtooth.

621.397.62 **1500**

The 625-Line C.C.I.R. System : a Line Timebase Investigation.—R. R. Harman. (*J. Telev. Soc.*, Oct./Dec. 1954, Vol. 7, No. 8, pp. 334–337.) From field trials in Holland of a prototype receiver which incorporated both normal and flywheel synchronization circuits, the necessity of providing a flywheel circuit in order to obtain acceptable pictures for input signals < 1 mV and its desirability even at higher input levels were established. The circuit will also deal with pulse interference and receiver noise, when these are not severe.

621.397.62(083.74) **1501**

An Intermediate Frequency for C.C.I.R. Television Standards.—H. B. S. Brabham. (*J. Telev. Soc.*, Oct./Dec. 1954, Vol. 7, No. 8, pp. 338–342 .. 346.) Conditions are discussed for ensuring that a superheterodyne receiver shall be free from spurious response generated in the mixer and detector, shall not itself cause interference and shall be reasonably immune from outside interference. A chart is presented which shows that in order to avoid spurious responses, the i.f. must have a mid-band frequency between 36 and 39 Mc/s. 37·25 Mc/s is recommended. This choice will also avoid local-oscillator radiation within band I. Field tests in Holland gave satisfactory results. External transmitter interference can be dealt with by providing a simple frequency-selective trap.

621.397.621.2 **1502**

Spurious Line Scan Resonances.—K. G. Beauchamp. (*Wireless World*, March 1955, Vol. 61, No. 3, pp. 109–114.) The generation of various types of unwanted oscillation by the line-scan-circuit output valve is discussed and methods for reducing their effects on the picture are outlined.

621.397.7 + 621.397.61 **1503**

Rowridge Television Transmitting Station.—(*Engineer, Lond.*, 19th Nov. 1954, Vol. 198, No. 5156, p. 711.) Brief details are given of this B.B.C. station, where regular service was inaugurated in November 1954. Operation is in channel 3, with vision on 56·75 Mc/s and sound on 53·25 Mc/s. Modulation of the main vision transmitter is at low level; peak-white output is 5 kW; no separate filter is used for shaping the vestigial sideband. The sound transmitter is a conventional class-B modulated equipment rated at 2 kW output. The vision programme reaches Rowridge from London via a repeater station and a microwave radio link; the sound programme is conveyed by telephone circuits. A single tower carries the microwave receiving aerial and the two-stack-dipole temporary transmitting array.

621.397.7 **1504**

Operating Experiences with the B.B.C. Television Studios at Lime Grove.—D. C. Birkinshaw. (*J. Telev. Soc.*, Oct./Dec. 1954, Vol. 7, No. 8, pp. 315–332.) Developments at Lime Grove since April 1952 are critically discussed. Extra channels including a flying-spot/Mechau system have been added to the telecine equipment. For telerecording the inverted Mechau system now has a better performance than the suppressed-frame system. Since all large studios have to be used for different types of production, a compromise acoustic treatment imparting a moderate degree of 'aliveness' has been given by applying a certain amount of plasterboard to the walls. Lighting technique is under review. Complex vision mixers are to be replaced by simpler units. Other equipment and problems are also discussed.

621.397.7 **1505**

Special Effects for Television Studio Productions.—A. M. Spooner & T. Worswick. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, p. 68.) Discussion on 561 of 1954.

621.397.7 : 535.623 : 628.972 **1506**

Color Television Light Sources.—H. M. Gurin. (*J. Soc. Mot. Pict. Telev. Engrs*, Aug. 1954, Vol. 63, No. 2, pp. 51–54.) Factors leading to the choice of tungsten illumination for use with the N.T.S.C. system are discussed. Operating experience is described.

621.397.743 **1507**

I.T.A. [Independent Television Authority] **Transmitters.**—(*Wireless World*, March 1955, Vol. 61, No. 3, pp. 120–122.) Problems of siting the I.T.A. band-III stations are discussed. Co-siting with B.B.C. band-I stations leads to simplification of receiving aerials but involves difficulties in the design of the transmitting aerials. Because of the different population distributions in the service areas of the B.B.C. stations, the desirability of co-siting must be considered separately for each case.

TRANSMISSION

621.396.61 : 621.373.42 **1508**

Navy Transmitter uses Frequency Synthesizer.—H. Romander & R. Watson. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 138–143.) A transmitter for telegraphy or facsimile is set to any frequency from 30 to 600 kc/s accurate to within 3 c/s, by setting four dials. Details are given of the signal generator, in which the desired frequency is obtained by synthesis of selected multiples of 1 kc/s, using a continuously variable Wien-bridge oscillator for interpolation.

VALVES AND THERMIONICS

621.314.63 + 621.314.7 **1509**

Semiconductor Devices made with Single Crystal Germanium-Silicon Alloys.—R. A. Logan, A. J. Goss & M. Schwartz. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1551–1552.) The formation of *p-n* junctions by solid-phase diffusion of impurities into the crystal [2226 of 1954 (Pearson & Fuller)] is well suited for use with Ge-Si alloys. Characteristics of some diodes and transistors are reported briefly.

621.314.63 : 546.289 **1510**

A Note on the Effect of Temperature Gradients at Point Contacts on Germanium.—H. K. Henisch & P. M. Tipple. (*Proc. phys. Soc.*, 1st Aug. 1954, Vol. 67, No. 416B, pp. 651–652.) The effect of a temperature gradient on the resistance of the point contact is shown graphically, data being obtained from pulse measurements and by inference from d.c. measurement; for a given contact temperature the d.c. reverse resistance increases with increasing temperature gradient. If there is any appreciable hole current at large reverse voltages, the current should be sensitive to changes in the hole replacement rate. This should depend on temperature gradient as well as on actual contact temperature. An alternative explanation is considered, but it fails to account for the magnitude of the resistance changes.

621.314.63 : 546.623.86 **1511**

Use of AlSb for Crystal Valves.—G. Zielasek. (*Arch. elekt. Übertragung*, Nov. 1954, Vol. 8, No. 11, pp. 529–533.) Properties of AlSb relevant to its use in diodes are compared with those of Ge and Si; operational and economic advantages are indicated. For small signals, the forward slope of the AlSb diode is higher than that of the Ge diode. The diffusion voltage of AlSb is less than that of Ge and Si.

621.314.632 : 546.28 **1512**

A New High-Temperature Silicon Diode.—C. G. Thornton & L. D. Hanley. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 186–188.) An account is given of the preparation of a point-contact diode by a process involving bombardment of the Si surface with oxygen ions, using technique described by Ohl (1337 of 1952). The diode is characterized by (*a*) very low saturation currents, of the order of 1 μA, (*b*) high inverse-voltage operation (70–200 V), (*c*) low barrier capacitance ($< 0{\cdot}3$ pF), and (*d*) satisfactory operation at temperatures up to 200°C.

621.314.632 : 621.372.632 **1513**

Crystal Convertor.—J. Shimizu. (*Rep. elect. Commun. Lab., Japan*, Aug. 1954, Vol. 2, No. 8, pp. 1–8.) The processing and design of a Si crystal for frequency conversion in microwave receivers and transmitters are discussed. Experimental studies are reported on the effect of contact pressure and heat treatment on the d.c. characteristic and in particular the influence of spreading resistance and barrier capacitance on the conversion loss. Results of measurements made at 4 kMc/s on a series of rectifiers type IN23B and SH5A are given.

621.314.7 **1514**

Reliability of Quantity Produced Transistors in Low Power Audio Applications.—F. M. Dukat. (*Trans. Inst. Radio Engrs*, Dec. 1954, No. PGQC-4, pp. 32–39.) A report based on the performance of about one million diffused-junction *p-n-p* transistors, with plastic encapsulation and leads sealed in glass, used in hearing aids.

621.314.7 **1515**

Theory of Diffusion-Type and Drift-Type Transistors: Part 3 — Design.—H. Krömer. (*Arch. elekt. Übertragung*, Nov. 1954, Vol. 8, No. 11, pp. 499–504.) In drift transistors with the drift field produced by non-uniform doping, undesirably high emitter capacitance can be reduced by using several different semiconductors. The field can alternatively be produced by altering the width of the forbidden band, by preparing the base from a non-stoichiometric mixed crystal (e.g. Ge-Si) of graded composition. Variants of this method are indicated. If the current density is above a certain value the drift transistor behaves as an ordinary diffusion type; high distortion is produced in the transition range. Requirements for avoiding this condition are indicated. The characteristic curves are examined; they are straighter and more nearly parallel for the drift transistor than for the diffusion type. The results indicate that for the same base thickness the drift type is superior as regards frequency cut-off, gain, and undistorted power. Part 2 : 579 of February.

621.314.7 **1516**

Introduction to Transistor Electronics.—H. K. Milward. (*Wireless World*, Feb. & March 1955, Vol. 61, Nos. 2 & 3, pp. 60–65 & 133–136.) The operation of junction transistors is explained simply in terms of the potential gradients and current-carrier paths in the semiconductor.

621.314.7 : 546.289 **1517**

On the Current Gain of Germanium Filamentary Transistors.—R. Lawrance, A. F. Gibson & J. W. Granville. (*Proc. phys. Soc.*, 1st Aug. 1954, Vol. 67, No. 416B, pp. 625–635.) Current-gain/temperature measurements were made on filamentary transistors of *n*-type Ge single crystals having resistivities between 2 and 8 Ω. cm. Results indicate that hole trapping is responsible for the high current gain observed at low temperatures and low emitter currents. Evidence from ion-bombardment and illumination experiments suggests that the holes are trapped in a surface channel produced by the minimum potential energy for holes near the surface. The mobility of a hole in the channel is believed to be very small and the lifetime of a hole in the channel very long.

621.314.7 : 546.289 **1518**

Current Multiplication Processes in *n*-Type Germanium Point-Contact Transistors.—C. A. Hogarth. (*Proc. phys. Soc.*, 1st Aug. 1954, Vol. 67, No. 416B, pp. 636–643.) Experiments are reported which indicate that, for type-A transistors, the rise in current gain associated with low emitter current is a feature of the collector contact and is not associated with the type of traps discovered by Lawrance (2332 of 1953 and 2130 of 1954). The increase in current gain could be accounted for by a decrease in barrier height due to holes arriving in the vicinity of the collector. Experiments gave results supporting this theory.

621.314.7 : 621.375.4.029.3 : 621.396.822 **1519**

Investigations of Noise in Audio-Frequency Amplifiers using Junction Transistors.—Bargellini & Herscher. (See 1302.)

621.314.7.001.4 **1520**

A Versatile Transistor Tester.—Bailey. (See 1428.)

621.383.5 **1521**

Physical Properties of Thin Photosensitive Films of Cadmium Sulphide.—G. Wlérick & F. Prégermain. (*J. Phys. Radium*, Nov. 1954, Vol. 15, No. 11, pp. 757–764.) The suitability of CdS cells for measurements of low luminous intensities was investigated. For each cell tested a critical temperature seems to exist above which there is no equilibrium value of current. At lower temperatures photoelectric inertia is troublesome, and it is essential to use only cells that have been kept in the dark for at least 24 hours. A self-quenching effect at high intensities and anomalies in the initial slope of the decay curve after exposure to light before the commencement of the test were also observed.

621.385.029.6 **1522**

Complex-Frequency Analysis for Transit-Time Valves.—F. W. Gundlach. (*Fernmeldetech. Z.*, Nov. 1954, Vol. 7, No. 11, pp. 598–607.) Conditions for growth of oscillations in transit-time valves are analysed in terms of complex frequencies and complex transit angles by extending the linear theory presented previously (1825 of 1950). The solutions depend on the frequency variation of the admittance of the valve-circuit combination. The admittance variations with complex frequency are determined for a number of passive circuit elements and are shown graphically. Types of valve considered are (*a*) space-charge diode, (*b*) reflex klystron, (*c*) dynatron, and (*d*) travelling-wave.

621.385.029.6 **1523**

Noise in Cut-Off Magnetrons.—R. C. Glass, G. D. Sims & A. G. Stainsby. (*Proc. Instn elect. Engrs*, Part B, Jan. 1955, Vol. 102, No. 1, pp. 81–86.) Measurements have been made of the noise fluctuations in the anode current at anode voltages ranging from zero to the value at which oscillations start. Noise peaks are observed at frequencies which vary in a regular manner with anode voltage and with magnetic field strength. The results indicate that the space charge is in a state of oscillation even at very low voltages, and these oscillations explain the very high electron temperatures that have been observed. The results also explain the high rates of rise of r.f. amplitude obtained with pulsed magnetrons. It seems probable that the pre-oscillation modes largely determine the oscillation mode. An investigation of the influence of parameters such as cathode diameter on the space-charge oscillations should be useful.

621.385.029.6 **1524**

A Coupled-Mode Description of Beam-Type Amplifiers.—H. Heffner. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 210–217.) Analysis for klystron and travelling-wave valves is presented in which the electron beam and the circuit are treated as coupled transmission lines. Expressions are derived for the a.c. power flow.

621.385.029.6 **1525**

On the Minimum Noise Figure of Traveling-Wave Tubes.—S. W. Harrison. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, p. 227; *Sylvania Technologist*, Oct. 1954, Vol. 7, p. 123.) A general proof is given that minimum noise is attained at the same beam voltage as maximum gain, assuming absence of correlation between initial-velocity and initial-current fluctuations.

621.385.032.216 **1526**

International Congress to mark the Fiftieth Anniversary of the Oxide Cathode.—(*Le Vide*, Nov. 1954, Vol. 9, No. 54, pp. 224–316.) The text is given of the following further papers:—

Properties of Hot Cathodes for Microwave Valves (pp. 224–233).—D. Charles & H. Huber.

Examples of Hot Cathodes for Microwave Valves (pp. 234–243).—H. Huber & D. Charles.

Cathodes for Magnetrons (pp. 244–248).—A. Dubois.

Conditions imposed on Hot Cathodes for C.R. Tubes (pp. 249–252).—C. Dufour & G. Wendt.

Oxide Cathodes in Gas-Discharge Lamps (pp. 253–256).—P. L. Voreaux.

A Self-Heating Emissive Electrode with Fused Active Layer, for Luminescent and Fluorescent Tubes (pp. 257–260).—P. Delrieu & R. Penon.

Cathodes for Hydrogen-Filled Thyratrons (pp. 261–265).—P. Leduc.

Active Cold Cathode for Gas-Filled Tubes (pp. 266–268).—C. Biguenet.

Applications of the L Cathode (pp. 269–272).—A. Venema.

Ionic Impact and Gas Contamination of the L Cathode (pp. 273–278).—S. Fugawa & H. Adachi. English version included.

Evaporation of the Barium from Capillary Metal Cathodes (pp. 279–283).—H. Katz. German version included.

The 'Impregnated' Cathode and its Structural Characteristics compared with the 'L' Cathode (pp. 284–289).—R. Levi. English version included.

Thermionic Properties of Moulded Cathodes made from Metal and Alkaline-Earth Oxides (pp. 290–296).—R. Uzan.

Directly Emissive Sintered Thermionic Cathodes (pp. 297–301).—Nguyen Thien-Chi & P. Dussaussoy.

A New Type of Diffusion Cathode (pp. 302–309).—A. H. Beck, A. D. Brisbane, A. B. Cutting & G. King. English version included.

Preliminary Work on Cathodes of the 'Barium-Salt-Based Moulded' Type (pp. 310–316).—H. Huber & J. Freytag.

For previous lists see 1216 of April.

621.385.15 : 621.318.57 **1527**

Storage Tube employs Secondary Emission.—W. E. M. Uhlmann. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 161–163.) A switching valve ('memotron') designed for telephone systems is described. The anode comprises a cylinder surrounding a coaxial squirrel cage, with the 20 secondary emitting storage elements located in the annular space between them.

621.385.3 + 621.385.5 **1528**

Electron-Optical Treatment of Current Division in Radio Valves.—S. Deb. (*Indian J. Phys.*, Aug. 1954, Vol. 28, No. 8, pp. 349–364.) The method of investigation described previously in relation to the planar triode (1533 of 1953) is extended to the case of nonplanar triodes and pentodes. Formulae are derived for the focal lengths of the aperture constituted by adjacent grid wires and the ratio of grid current to total current in a cylindrical triode, and for the ratio of screen-grid current to anode current in a pentode. Experiments with rubber-membrane models are reported.

621.385.832 **1529**

Use of Electron Guns with Spherically Curved Electrodes in Cathode-Ray Tubes.—J. Laborderie. (*Ann. Radioélect.*, Oct. 1954, Vol. 9, No. 38, pp. 366–373.) The design of a Pierce-type gun for low-intensity beams is considered, in particular the ratio of the radius of curvature of the cathode to that of the anode, which ratio must be large. In an experimental tube with cathode-target distance 20 cm and voltage 1 kV, spot radius was 0·15 mm with current density 50 mA/cm².

621.385.832 : 681.142 **1530**

The Physics of Cathode-Ray Storage Tubes.—C. N. W. Litting. (*J. sci. Instrum.*, Oct. 1954, Vol. 31, No. 10, pp. 351–356.) A non-mathematical account is given of the principal theories of the c.r.-storage-tube mechanism and of experiments made to test these theories. Theory based on the triode valve explains the experimental results obtained at Manchester and also explains the continued usefulness of the original theory of Williams & Kilburn (2258 of 1949).

621.387 : 621.318.57 **1531**

A Novel Gas-Gap Speech Switching Valve.—A. H. Beck, T. M. Jackson & J. Lytollis. (*Electronic Engng*, Jan. 1955, Vol. 27, No. 323, pp. 7–12.) Cold-cathode gas-filled valves are described, designed to give low noise (at least 60 db below signal level) and low striking resistance (about 100 Ω) independent of signal frequency up to at least 50 kc/s. The electrode arrangement comprises cathode and twin anodes; several practical forms are illustrated. Multi-gap and single-gap variants are also discussed. The devices are intended for telephone switching applications.

621.387.032.213 **1532**

The Emission from Hot Cathodes in Gas Discharges.—A. E. Pengelly & D. A. Wright. (*Brit. J. appl. Phys.*, Nov. 1954, Vol. 5, No. 11, pp. 391–395.) The emission was investigated experimentally for both directly and indirectly heated cathodes, over a wide range of current. The condition of zero-field thermionic emission was identified in the presence of a discharge in inert gas; emission from cathodes in Ar, at zero field, is generally equal to the emission in vacuum. At very high currents the total electron emission is greater than the thermionic emission, either because of field enhancement or because of the Townsend γ multiplication process at the cathode. Results are tabulated and presented graphically.

MISCELLANEOUS

061.6 : [621.396.9 + 681.142 **1533**

Electronics Research Laboratory in Scotland.—(*Engineer, Lond.*, 22nd Oct. 1954, Vol. 198, No. 5152, pp. 565–566.) A brief account of the layout of the new Ferranti laboratory at Edinburgh and mention of some of the items under investigation, including control of machines by digital computers, and radar development. A similar account is given in *Engineering, Lond.*, 22nd Oct. 1954, Vol. 178, No. 4630, pp. 537–538.

621.396 : 061.24 **1534**

The Seventh Plenary Assembly of the International Radio Consultative Committee.—E. W. Allen. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 132–139.) An outline is given of the organization and functions of the C.C.I.R. and of the discussions and recommendations of the Assembly held in London in 1953.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.121.2 **1535**

Symmetry of Vibrating Square Membrane.—M. D. Waller. (*Proc. phys. Soc.*, 1st Dec. 1954, Vol. 67, No. 420B, pp. 895–898.) Vibrations of free square plates always conform with the symmetry of the surface; this experimental conclusion conflicts with the accepted theoretical conclusion that two normal modes of vibration of the same frequency can combine regardless of symmetry considerations. This conflict is discussed. See also *Acustica*, 1954, Vol. 4, No. 6, pp. 677–680.

534.2 : 534.833 **1536**

The Propagation of Sound in Granular Substances.—H. Schmidt. (*Acustica*, 1954, Vol. 4, No. 6, pp. 639–652. In German.) Theory is developed and measurements are reported of the loss factor and propagation velocity of granular substances (*a*) for substances packed in a bar-shaped container, (*b*) for a layer of the substance on top of an Al bar. In case (*a*) sand, with varying water content, glass spherules 1 mm in diameter, finely broken brick, cinders and coarse iron filings were used, in case (*b*) only sand and brick. For application as a filling, e.g. for sound insulation in buildings, cinders or broken brick are recommended, with wood shavings or rock wool added where necessary to reduce the resonance frequencies to very low values.

534.21-8 **1537**

The Propagation of Sound in Solutions of Rubber and Perspex.—A. W. Pryor. (*Acustica*, 1954, Vol. 4, No. 6, pp. 658–661.) Absorption measurements at four frequencies in the range 4–17·3 Mc/s were made on three rubber-in-benzene solutions and on one perspex-in-pyridine solution. "The absorption was less than in the pure solvents and there is evidence of relaxation. Measurements of the shear viscosity of a 10% rubber solution showed that the relaxation of the high flow viscosity was complete even at 50 kc/s. The absorption in the solutions must therefore be ascribed to the 'bulk viscosity' of the solvents."

534.22-14 **1538**

Measurements by Optical Methods of the Sound Velocity in Aqueous Solutions of Electrolytes in dependence on Concentration and Temperature.—K. Tamm & H. G. Haddenhorst. (*Acustica*, 1954, Vol. 4, No. 6, pp. 653–657.)

534.6 : 621.373.4 : 621.374 **1539**

Generation and Use of Single-Frequency Pulses in Electroacoustics and Musical Acoustics.—H. Lackner. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, Nov./Dec. 1954, Vol. 8, Nos. 11/12, pp. 141–152.) Analysis is presented showing how the spectrum of a short train of sinusoidal oscillations depends on its duration and on the initial and final phase. A circuit for a generator providing pulses of variable duration and phase is described. Advantages of using such signals for testing loudspeakers and musical instruments are indicated.

534.846 **1540**

Improvements in the Acoustics of the Budapest Civic Theatre.—T. Tarnóczy. (*Acustica*, 1954, Vol. 4, No. 6, pp. 665–671. In German.) The upper walls and part of the ceiling were provided with a diffusive surface, made of reinforced plaster of Paris. The rest of the ceiling was plastered over. The lower walls and the new proscenium were lined with wood panelling, which acted as an acoustic resonator. A sound-amplification system is available if required. These measures sufficed to remove flutter echoes and almost all other audible echoes, to increase the reverberation time to 1·6 sec, and to make the distribution of sound energy completely satisfactory in almost every part of the theatre. High frequencies have been enhanced and tonal quality is good.

534.86 **1541**

Advances in the Reproduction of Music.—F. Winckel. (*Funk u. Ton*, Nov. & Dec. 1954, Vol. 8, Nos. 11 & 12, pp. 604–607 & 649–652.) A series of brief reports on lectures delivered at three conferences held in 1954. The subjects covered include a combination loudspeaker unit, automatic volume control, a new compressor-expander system with variable time delay, and the quality of microphones and loudspeakers.

534.861 : 534.76 **1542**

Experiences in Stereophonic Broadcast Transmissions.—J. J. Geluk. (*Funk u. Ton*, Dec. 1954, Vol. 8, No. 12, pp. 631–634.) Report dealing mainly with Dutch experimental transmissions.

534.862 : 534.76 **1543**

Stereophonic Sound-Film Recording and Reproduction.—H. Friess. (*Funk u. Ton*, Dec. 1954, Vol. 8, No. 12, pp. 622–630.) A review of current problems and technique.

621.395.616 **1544**

Note on the Stabilization of the Response of a Capacitor Microphone.—C. Colin. (*J. Phys. Radium*, Dec. 1954, Vol. 15, No. 12, pp. 820–822.) It is possible to improve the response of a capacitor microphone by negative feedback if (*a*) an auxiliary electrode is included, and (*b*) the voltage output is in phase with diaphragm displacement. An analysis is made of the necessary coupling conditions, both mechanical and electrical.

621.395.625.3 **1545**

A Survey of Magnetic Recording.—S. J. Begun. (*Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, pp. 1115–1118.) Includes a description of operation and an indication of the development and applications.

621.395.625.3 **1546**

Making Magnetic Sound-Records Visible.—W. Guckenburg. (*Funk u. Ton*, Nov. 1954, Vol. 8, No. 11, pp. 600–604.) A review of various methods using suspensions of ferromagnetic dust. Photographs illustrating applications, such as detecting faulty magnetic heads, are briefly discussed.

AERIALS AND TRANSMISSION LINES

621.315.28 : 621.395.44 **1547**

A Transatlantic Telephone Cable.—M. J. Kelly, G. Radley, G. W. Gilman & R. J. Halsey. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 117–130. Discussion, pp. 130–138.) The inadequacy of radio circuits to cope with transatlantic communications is discussed and a general description is given of the cable system for linking the United Kingdom, Canada and the United States; this is planned for completion in 1956 and will provide 36 telephone circuits across the Atlantic and 60 between Newfoundland and Nova Scotia. The project has been made possible by the development of submerged repeaters containing long-life valves and other components.

621.372 **1548**

The Launching of a Plane Surface Wave.—G. J. Rich. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 237–246.) Experiments are described on the propagation of surface waves at about 3 cm λ over plane brass plates with polystyrene coatings of thickness such that only the TM_0 mode is propagated. Various launching devices were tried; the best found was a 'double-cheese' device with a launching efficiency of about 50%. Experimentally found values for the efficiency of this device are in agreement with theory for apertures of dimensions smaller than λ. Deviations from theoretical values observed for larger apertures indicate that to obtain good launching efficiency the field distribution within the aperture must be to a close approximation exponential.

621.372.22 **1549**

The Matrix Equation of Loss-Free Exponential Lines.—B. Beghin. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 168–170.) A solution of the differential equation for the exponential line is presented in the form of the product of two affine exponential expressions representing a ladder arrangement of two quadripoles, the one a perfect transformer and the other analogous to a uniform line. Reflection can be eliminated by terminating the line with a complex impedance.

621.372.8 **1550**

The Propagation of an Electromagnetic Wave along an Infinite Corrugated Surface.—R. A. Hurd. (*Canad. J. Phys.*, Dec. 1954, Vol. 32, No. 12, pp. 727–734.) The problem is analysed by a method based on the calculus of residues; the slot walls constituting the corrugations are assumed to be vanishingly thin. Exact expressions are obtained for the mode amplitudes and phase velocities; these are valid for frequencies near cut-off, when the number of slots per wavelength is about five or more.

621.372.8 **1551**

A Simple Waveguide Directional Coupler.—P. Andrews. (*J. Brit. Instn Radio Engrs*, Feb. 1955, Vol. 15, No. 2, pp. 112–116.) A simply constructed, orthogonally crossed unit is described giving constant coupling and directivity over a wide frequency band. Coupling factor and directivity are calculated for two typical cases for 3 in. × 1½ in. waveguide. An expression is derived for the frequency sensitivity of the device.

621.372.8.002.2 **1552**

Surface Roughness and Attenuation of Precision-Drawn, Chemically Polished, Electropolished, Electroplated and Electroformed Waveguides.—J. Allison & F. A. Benson. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 251–259.) "Detailed examinations of certain 3 cm waveguides have shown that the surface finish of precision-drawn tubing as manufactured at present is quite adequate for most applications. Such surfaces, however, may be improved, if desired, by careful chemical or electrolytic polishing or electroplating in bright baths under closely controlled conditions. Some information on the surface finish of copper guides electroformed on various types of mandrel is also presented. Formulae for calculating the attenuation of any H or E mode in a rectangular waveguide, so as to take account of surface roughness, have been developed from the original expressions derived by Kuhn. A method is given for determining the actual value of attenuation in a waveguide sample without having to make careful measurements with elaborate equipment on long specimens. A description is included of a new and simple technique, involving electropolishing, for examining the internal surface finish of waveguides; the method cannot, however, be used successfully on silver-plated sections."

621.372.8.029.65.002.2 **1553**

The Electroforming of Components and Instruments for Millimetre Wavelengths.—A. F. Harvey. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 223–230.) Electroforming processes considered for producing waveguide components include periodic-reverse-current plating. Either permanent or disposable formers may be used. The electroformed parts are designed to facilitate subsequent machining. Data are tabulated on a range of waveguides with internal cross-sections from 0·28 × 0·14 in. to 0·034 × 0·017 in. which have been standardized for the Joint Services, and various units incorporating these elements are illustrated.

621.396.67 : 539.23 **1554**

Possibilities of Radiation from Thin Metal Films.—M. Gourceaux. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 170–172.) Systems with rotational symmetry and circular current paths are considered. Expressions are derived for the values of film thickness and current frequency for which radiation can occur with cylindrical and spherical arrangements.

621.396.676.2 **1555**

The Notch Aerial and some Applications to Aircraft Radio Installations.—W. A. Johnson. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 211–218.) Analysis and experiments show that metallic sheets with notches cut perpendicular to an edge can make very efficient aerials. Wide-band characteristics can be obtained with a notch about $\lambda/4$ deep but the detail of the polar diagram may vary with frequency, depending on the shape and size of the sheet. Notches short compared with λ—termed 'nitches'—can be operated either as fixed-tuned narrow-band aerials or, in association with a tuning unit, over a wider band. For reception at frequencies around 100 Mc/s a notch of length about 3 in. is adequate. Tests made with aircraft tail fins and wings are described; h.f., v.h.f. and u.h.f. types are practical.

621.396.677 : 523.16 **1556**

Aerial Smoothing in Radio Astronomy.—Bracewell & Roberts. (See 1638.)

621.396.677.029.62/.63 : 621.397.6 **1557**

U.H.F. and V.H.F. Antenna.—R. F. Kolar. (*Radio-Electronics*, Dec. 1954, Vol. 25, No. 12, pp. 60–62.) A low-cost television receiver aerial unit is described; the design is based on stacked u.h.f. V's and an u.h.f. dipole and reflector. The power gain relative to a $\lambda/2$ dipole is a few decibels.

621.396.677.31 **1558**

Optimum Element Spacing of Uniform Broadside Arrays.—R. F. H. Yang. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 115–116.) Collinear and curtain arrays are considered. A brief analysis indicates that the optimum element spacing for a collinear array is λ, irrespective of n, the number of elements, while the optimum spacing for a curtain array is given approximately by the formula $d/\lambda = 0{\cdot}6 + \frac{1}{3}\log_{10} n$. This result is different from that obtained by Hammond (1909 of 1953).

621.396.677.8.029.65 **1559**

Some Experiments on the Reflecting Properties of Metal-Tube Lens Medium.—E. M. Wells. (*Marconi Rev.*, 3rd Quarter 1954, Vol. 17, No. 114, pp. 74–85.) Experiments described show qualitatively the variation of the reflection coefficient with angle of incidence, plane of incidence, and plane of polarization. With the E-vector in the plane of incidence a very pronounced anomalous reflection was observed. This was further investigated. The wavelengths used were in the band 8–10 mm.

AUTOMATIC COMPUTERS

681.142 **1560**

Wide-Band Analog Function Multiplier.—J. A. Miller, A. S. Soltes & R. E. Scott. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 160–163.) Operation of the multiplier is based on the formula $xy = \frac{1}{4}[(x + y)^2 - (x - y)^2]$. The squaring is effected by means of beam-deflection tubes with parabolic characteristics [2940 of 1950 (Soltes)].

681.142 **1561**

Analogue Computer with Stepping-Switch Drive for the Solution of Algebraic Equations of up to Sixth Degree.—H. Hörner & H. Zemanek. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, Nov./Dec. 1954, Vol. 8, Nos. 11/12, pp. 153–158.) The analogy used is that between a sinusoidal voltage and a complex quantity. The representation of the polynomials is effected using feedback amplifiers as computing elements. The zero points corresponding to the solutions are found automatically.

681.142 **1562**

Some Devices permitting Study of the Variable Regime in the Transportation of Gas in Pipes.—A. Blanc. (*C. R. Acad. Sci., Paris*, 3rd Jan. 1955, Vol. 240, No. 1, pp. 45–46.) A particular application is discussed of the analogue-computer arrangements described previously (2317 of 1954).

681.142 **1563**

Programming a Digital Computer for Cell Counting and Sizing.—W. Welkowitz. (*Rev. sci. Instrum.*, Dec. 1954, Vol. 25, No. 12, pp. 1202–1204.)

681.142 : 538.221 **1564**

Magnetic Materials for Digital-Computer Components: Part 1—A Theory of Flux Reversal in Polycrystalline Ferromagnetics.—Menyuk & Goodenough. (See 1713.)

681.142 : 621.3.042 **1565**

Logical and Control Functions performed with Magnetic Cores.—S. Guterman, R. D. Kodis & S. Ruhman. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 291–298.) Use of magnetic cores with square hysteresis loops in digital-computer systems based on the 'single-line' shift register is described.

681.142 : 621.375.23 **1566**

A Technique for Nonlinear-Function Generation.—P. N. Nikiforuk. (*Electronic Engng*, March 1955, Vol. 27, No. 325, pp. 118–119.) A method is described for converting a circuit whose output is proportional to the nth root of the input to give the nth power, or vice versa. A practical circuit, based on a variable-gain feedback amplifier, for dealing with squares and square roots is illustrated.

681.142 : 621.376 **1567**

Two New Electronic Analog Multipliers.—M. A. Meyer & H. W. Fuller. (*Rev. sci. Instrum.*, Dec. 1954, Vol. 25, No. 12, pp. 1166–1172.) Improved types of four-quadrant multipliers for deriving the product of two time functions are described. One uses a double-amplitude modulation scheme applying the work of Sternberg & Kaufman on the two-frequency-modulation-product problem (2212 of 1954). The other uses successive phase modulation and amplitude modulation of a carrier. The accuracy obtainable is discussed.

681.142 **1568**

Automatic Digital Computation. [Book Review]—Publishers: H.M. Stationery Office, London, 296 pp., 21s. (*Instrum. Practice*, Dec. 1954, Vol. 8, No. 12, p. 1094.) Contains discussions and original papers presented at the symposium held at the National Physical Laboratory in March 1953.

CIRCUITS AND CIRCUIT ELEMENTS

621.314.22.042 **1569**

Calculation of Losses in Transformer Cores.—A. L. Morris. (*Engineer, Lond.*, 17th & 24th Dec. 1954, Vol. 198, Nos. 5160 & 5161, pp. 837–839 & 875–877.) Expressions for core losses are developed which take account of the nonuniformity in the flux distribution across the face of the core plates. The nonuniformity across the stack of plates is neglected.

621.318.4 : 538.221 : 621.396.822 **1570**

The Noise generated in a Coil with a Ferromagnetic Core.—G. Builder & D. Haneman. (*Aust. J. Phys.*, Dec. 1954, Vol. 7, No. 4, pp. 654–658.) The discussion presented indicates that when there is no varying or alternating magnetization of the core, the noise can be calculated from the Nyquist formula, provided that the resistance of the coil is measured using an alternating voltage of such magnitude that the magnetization process remains linear.

621.318.435.3 **1571**

Composite Cores for Instrument Transductors.—E. H. Frost-Smith & A. E. DeBarr. (*Proc. Instn elect. Engrs*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 663–667. Discussion, pp. 667–671.) The characteristics of self-excited transducers are markedly dependent on the properties of the core material. Cores with satisfactory properties can be produced at reasonable cost by combining different materials. Experimental results are reported for a core comprising a mumetal bridge and a U-shaped grain-oriented Si-Fe yoke.

621.318.435.3 : 621.375.327 **1572**

Auto-Self-Excited Transductors and Push-Pull Circuit Theory.—A. G. Milnes & T. S. Law. (*Proc. Instn elect. Engrs*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 643–662. Discussion, pp. 667–671.) The modes of operation of transductors with parallel, bridge, and centre-tap connections are explained. Expressions are derived for the sensitivity and time-constant under idealized conditions. An examination is made of the use of transductors in push-pull pairs to obtain magnetic amplifiers with outputs whose polarity depends on the signal sense; the transductors are assumed to be of the auto-self-excited type with resistance loads.

621.318.5 **1573**

Component Design Trends—Special-Purpose Relays gain New Uses.—F. Rockett. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 150–156.)

621.318.5 : 621.318.134 **1574**

Time Delay in High-Speed Ferrite Microwave Switches.—R. C. LeCraw & H. B. Bruns. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, p. 124.) Measurements indicate that for an X-band switch using a rod of a particular Mg-Mn ferrite and actuated by a current pulse of given magnitude and rise time 17 mμs, the time delay of the switch is about 3·2 mμs.

621.319.4 : 621.315.614.6 **1575**

Study of the Dielectric in Paper Capacitors.—E. Briganti. (*Alta Frequenza*, June/Aug. 1954, Vol. 23, Nos. 3/4, pp. 139–156.) Measurements were made of the loss angle of wet and dry paper at −5°C, and of the permittivity of the impregnant and of the impregnated paper. From these an equivalent circuit was derived for the capacitor, which can be used in estimating the quality of the paper and desirable conditions of manufacture. Breakdown-strength measurements were also made to determine the optimum applied voltage.

621.372.5 **1576**

Arc Inductance and Dynatron Capacitance.—J. Groszkowski. (*Bull. Acad. polon. Sci.*, Classe 4, 1954, Vol. 2, No. 1, pp. 41–45. In English.) The stability of systems with nonlinear negative resistances of arc and dynatron types is discussed. Analysis indicates that though the arc can have some inductive properties and the dynatron capacitive ones, these are not essential to an explanation of the behaviour of the systems. Transient conditions and steady oscillation states are considered.

621.372.5 **1577**

Further Bounds existing on the Transient Responses of Various Types of Networks.—A. H. Zemanian. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 322–326.) Five theorems further to those presented previously (2331 of 1954) are proved and illustrated.

621.372.5 **1578**

An Approximate Treatment of Cascaded Four-Terminal Networks.—H. L. Armstrong. (*Electronic Engng*, March 1955, Vol. 27, No. 325, pp. 130–131.) "An approximate expression is derived for the *n*th power of a 2 × 2 matrix. The result is used in an approximate treatment of a ladder network used as a filter."

621.372.5 **1579**

The Approximation Problem of Network Synthesis.—S. Winkler. (*Trans. Inst. Radio Engrs*, Sept. 1954, Vol. CT-1, No. 3, pp. 5–20.) A review with 240 references.

621.372.5 **1580**

Series Resonant Circuit Theory.—A. J. Lyon. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 107–108.) Expressions are derived for the fractional errors in tuning capacitance, resonance frequency, maximum current, and selectivity at current resonance due (*a*) in the case of frequency tuning, to the frequency dependence of the circuit resistance, and (*b*) in the case of capacitance tuning, to capacitor losses and coil self-capacitance.

621.372.5 : 512.83 **1581**

The Mesh Counterpart of Shekel's Theorem.—S. Seshu. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, p. 342.) It is shown that whereas the determinant of the admittance matrix of a network is independent of the choice of reference node [2878 of 1954 (Shekel)], the corresponding statement for the mesh determinant is not true.

621.372.5 : 621.3.018.7 **1582**

Distortion of Arbitrary Waveforms by Resonance Sections.—E. William. (*Funk u. Ton*, Nov. 1954, Vol. 8, No. 11, pp. 592–599.) The method developed earlier (2032 of 1954) for *RC* sections is extended to sections including an inductance.

621.372.5 : 621.318.134 **1583**

Extension of Nonreciprocal Ferrite Devices to the 500–3 000 Mc/s Frequency Range.—R. H. Fox. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, p. 128.) Calculations indicate that devices, such as circulators, of reasonable dimensions can be designed for operation at frequencies below 3 kMc/s by using static magnetic fields of intensity greater than required for ferromagnetic resonance.

621.372.512.2.029.65 : 621.372.8 **1584**

A Short-Slot Hybrid for 9 mm.—E. M. Wells. (*Marconi Rev.*, 3rd Quarter 1954, Vol. 17, No. 114, pp. 86–87.) The X-band junction described by Riblet (1833 of 1952) was redesigned for a wavelength of 9 mm. A brief illustrated note on this junction is given.

621.372.512.24 **1585**

Resonance Conditions in a System of Two Circuits with Inductive Coupling.—U. Ruelle. (*Alta Frequenza*, June/Aug. 1954, Vol. 23, Nos. 3/4, pp. 157–177.) Assuming *M*, *R*, *L* and *C* constant, conditions are derived for the existence of one minimum and two maximum values of current in the secondary in the general and in two particular cases. The results are applied to a band-pass filter, and presented graphically for two different parameter values. Low Q values are assumed.

621.372.54 **1586**

Microwave Filters.—E. Willwacher. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 694–704.) Theory of filters comprising coaxial lines and/or waveguides is developed by reference to equivalent lumped-constant circuits. Band-pass and band-stop filters of ladder, amplifier and bridge types are discussed.

621.372.54 : 621.396.67 **1587**

Tunable Microwave Aerial Diplexer.—O. Laaff. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 688–693.) A diplexer for the band 2·1–2·3 kMc/s is based on the use of continuously tunable resonant circuits comprising coaxial-line sections short-circuited at one end and having a third coaxial conductor insulated from and sliding within the inner conductor. In a particular design illustrated, for 100-Mc/s separation between transmission and reception frequencies, the transmitted energy penetrating into the receiver is attenuated by 65 db.

621.372.543.2 **1588**

Theoretical Investigation of Three-Stage Tchebycheff-Type Band-Pass Filters.—B. Betzenhammer & E. Henze. (*Arch. elekt. Übertragung*, Dec. 1954, Vol. 8, No. 12, pp. 545–552.)

621.373.4 **1589**

Judging the Quality of Oscillator Circuits.—H. Haller. (*Funk u. Ton*, Nov. 1954, Vol. 8, No. 11, pp. 565–575.) Discussion of the frequency and amplitude stability of oscillators considered as composed of a slightly nonlinear frequency-independent amplifier and a linear frequency-dependent feedback quadripole. Stability is found to depend on the rate of change of the imaginary part of the voltage transfer characteristic of the feedback quadripole. The use of this criterion in the design of bridge-stabilized *RC* oscillators is illustrated. Measurements on and various faults of experimental oscillators are briefly discussed.

621.373.4 : 621.374 : 534.6 **1590**

Generation and Use of Single-Frequency Pulses in Electroacoustics and Musical Acoustics.—Lackner. (See 1539.)

621.373.431.1 + 621.375.2.018.756 **1591**

Experimental Investigations on Multivibrators and Amplifier Circuits with Secondary Electron Emission Valves as described by Kroebel.—K. E. Rumswinkel. (*Z. angew. Phys.*, Dec. 1954, Vol. 6, No. 12, pp. 551–556.) Multivibrators of the type described by Kroebel (383 of February) were investigated. Pulse flank slopes of the order of 10^{10} V/sec, up to pulse amplitudes of 67 V, were obtained. The multivibrator can be modified to act as a pulse amplifier without feedback.

621.373.44 : 535.33 **1592**

Equipment for Excitation of Spectra by High Frequency Pulses.—L. Minnhagen & L. Stigmark. (*Ark. Fys.*, 14th Dec. 1954, Vol. 8, Part 5, pp. 471–479. In English.) The equipment comprises a pulse generator which controls a Clapp oscillator (2193 of 1948) followed by a frequency multiplier and amplifiers. Average h.f. power transferred to the discharge tube is about 500 W, with peak power of 3 kW; the frequency is about 9 Mc/s. Argon spectra obtained are shown.

621.373.52 **1593**

Transistor Frequency Standard.—J. H. Smith, Jr, & M. Campbell. (*Tele-Tech*, Dec. 1954, Vol. 13, No. 12, pp. 90–91 .. 135.) This unit, designed primarily for geophysical prospecting, has a printed-circuit base and uses transistors in all stages. Accuracy is within 1 part in 10^4 over the range $-$ 40°F to $+$ 140°F. An 8-kc/s oscillator is followed by a pulse-forming amplifier and first divider stage, then by two dividers in parallel, whose outputs are mixed to obtain an output frequency of 100 c/s.

621.375.1.024 **1594**

The Transient Response of Direct-Current Amplifier Systems.—J. H. Sanders. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, pp. 453–455.) D.c. amplifiers of the d.c.-a.c. conversion type have an upper frequency response limited by the detector circuit, and when negative feedback is used transients are amplified considerably more than the steady signal. The form of the transient response and methods of reducing its magnitude are discussed.

621.375.2.049 **1595**

A Long-Lived Packaged Amplifier for Aircraft.—J. G. Matthews. (*Bell Lab. Rec.*, Dec. 1954, Vol. 32, No. 12, pp. 462–466.) The development and construction of units with a probable life of 2 000 hours are described. Selected valves are pressed into cast Al wells lined with a silicone rubber paste which is hardened by a short curing process; this is more effective for heat transfer than Al dust or foil. Deposited carbon resistors and capacitors serviceable at 125°C are mounted on a phenolic board supported by the Al base and wired to a recessed plug. The assembled unit, after testing, is embedded in liquid plastic which is then solidified. Test figures for heat dissipation under different conditions are given.

621.375.221 : 621.372.512 **1596**

Amplifier Stages with Transitionally Coupled Two-Stage Band-Pass Filters, particularly for Large Bandwidths.—W. Mansfeld. (*Funk u. Ton*, Nov. 1954, Vol. 8, No. 11, pp. 576–591.) The amplitude and group-delay characteristics of an amplifier stage consisting of two coupled circuits are analysed for the case when the amplification is constant over a wide frequency band ('transitional' coupling). The case when the damping factors d_1 and d_2 of the two circuits are equal is considered first, and formulae are also given for the cases of either d_1 or d_2 tending to zero. Formulae are also given for transforming a filter with indirect inductive coupling into one with direct inductive coupling. Design curves are shown.

621.375.23 : 621.3.016.35 **1597**

Nyquist's Criterion for Multiple-Loop Feedback Circuits.—L. Tasny-Tschiassny. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 114–115.) A method of deriving the stability criterion alternative to that of Cutteridge (3489 of 1954) and based on conformal transformation is presented. See also 72 of January (Cutteridge).

621.375.232 **1598**

The Effect of Inverse Feedback on Input Impedance.—J. B. Earnshaw. (*Radio elect. Rev., Wellington, N.Z.*, Dec. 1954 & Jan. 1955, Vol. 9, Nos. 10 & 11, pp. 37–40 & 34–35.) Formulae are given for the input impedance, gain, and gain without feedback of twelve single-stage amplifiers and these, together with the circuits and their equivalents, are tabulated.

621.375.3 **1599**

Alteration of Dynamic Response of Magnetic Amplifiers.—R. O. Decker. (*Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, p. 1088.) Digest of paper published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954, pp. 658–664. Analysis is presented indicating how a magnetic amplifier of full-wave self-saturating type can be made to exhibit phase lead or lag by adjusting the parameters of the feedback networks.

621.375.4 : 621.314.7 **1600**

Analysis of the Common-Base Transistor Circuit.—F. Oakes. (*Electronic Engng*, March 1955, Vol. 27, No. 325, pp. 120–126.) Simple equations are obtained by choosing a hybrid inverted-Π network as the equivalent circuit for investigating the operation of the grounded-base point-contact transistor amplifier.

621.375.4 : 621.314.7 **1601**

D.C. Stability of Transistor Circuits.—F. Oakes. (*Wireless World*, April 1955, Vol. 61, No. 4, pp. 164–167.) The design of amplifiers using junction transistors is discussed, with particular reference to the influence of the base-to-collector leakage current, which increases rapidly with rising temperature. For stable operation, the change of collector current produced by a change of leakage current should be low; circuit arrangements for achieving this are indicated.

621.376.3 : 621.3.018.78 : 621.372.5 **1602**

The Distortion of F.M. Signals in Passive Networks.—R. H. P. Collings & J. K. Skwirzynski. (*Marconi Rev.*, 4th Quarter 1954, Vol. 17, No. 115, pp. 113–136.) Expressions for the fundamental and first four harmonics of the output instantaneous frequency are given in a series expansion in terms of modulation frequency and modulation index, the coefficients in the expansion depending on the network parameters. Effects of detuning are considered, and detailed results for the Butterworth circuit are presented.

621.376.3 : 621.3.018.78 : 621.372.543.2 **1603**

The Linear Distortion of F.M. Signals in Band-Pass Filters for Large Modulation Frequencies.—J. K. Skwirzynski. (*Marconi Rev.*, 4th Quarter 1954, Vol. 17, No. 115, pp. 101–112.) The linear distortion of a f.m. signal in a highly selective band-pass filter follows almost exactly the static response curve of the network, provided the following conditions are fulfilled: (*a*) the modulation frequency is not less than two-thirds of the semi-bandwidth, (*b*) the modulation index does not exceed unity, (*c*) the network Q is sufficiently large.

621.376.32 : 621.318.134 **1604**

A Ferrite Frequency Modulator.—F. Slater. (*Marconi Instrumentation*, Dec. 1954, Vol. 4, No. 8, pp. 186–193, 200.) The modulator described comprises a ferroxcube-B4 ring carrying a r.f. winding and located in the gap of a Ni-Fe core carrying l.f. and polarizing windings. It is suitable for operation over the frequency range from 400 kc/s to u.h.f., with slight modifications. Its demodulated distortion is 5% at an oscillator frequency of 400 kc/s and a 15-kc/s frequency deviation, and 2% at 170 Mc/s and 100 kc/s, respectively.

621.376.332 **1605**

Discriminator Circuit Analysis.—F. L. Morris. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 93–98. Correction, *ibid.*, May 1955, Vol. 32, No. 5, p. 142.) Theory and performance figures are given for a simple frequency-discriminator circuit using an asymmetrical arrangement. The conversion efficiency compares favourably with that of the equivalent Foster-Seeley discriminator. It is particularly recommended for purposes where high efficiency is of greater importance than accurate linearity over a wide frequency range.

621.396.049.75 **1606**

A Universal Printed Circuit.—J. R. Goodykoontz. (*Tele-Tech*, Dec. 1954, Vol. 13, No. 12, pp. 74–75.) The universal printed-circuit board has a standard pattern of parallel wires on one side and is useful at the design stage, when prototypes are required for testing, since circuit changes may be made with relative ease.

621.372.5 **1607**

Amplitude-Frequency Characteristics of Ladder Networks. [Book Review]—E. Green. Publishers: Marconi's Wireless Telegraph Co., Chelmsford, 1954, 155 pp., 25s. (*Brit. J. appl. Phys.*, Dec. 1954, Vol. 5, No. 12, p. 457.) Suitable mainly as a reference work for telecommunication engineers.

GENERAL PHYSICS

53.081 **1608**

Proposals for Units for Area, Electric Displacement and Magnetic Field Strength.—P. Cornelius. (*Philips Res. Rep.*, Dec. 1954, Vol. 9, No. 6, pp. 444–457.)

537.21 + 538.12 **1609**

The Two-Dimensional Magnetic or Electric Field of a Single Isolated Pole-Piece.—N. H. Langton & N. Davy. (*Brit. J. appl. Phys.*, Dec. 1954, Vol. 5, No. 12, pp. 431–435.) Theoretical investigation for a pole-piece consisting of a thick plate terminated by a concave semicircular cylinder. Conformal transformations and elliptic functions are used. The variation of the field strength along the edge of the pole-piece and along the external axis of symmetry is calculated and shown graphically.

537.224 **1610**

Observation of the Costa Ribeiro Effect on the Dissolution of Naphthalene Crystals.—E. Rodrigues. (*Ann. Acad. bras. Sci.*, 31st Dec. 1954, Vol. 26, Nos. 3/4, pp. 381–383.) Report of experiments indicating that electric charges are developed on dissolving single crystals of naphthalene in a solvent of very low conductivity such as toluene; the crystals thus treated constitute natural electrets.

537.226 : 536.421.1 : 537.29 **1611**

Electro-fusion: a New Phenomenon observed in the Phase Changes of Dielectrics under the Influence of an Electric Field.—J. Costa Ribeiro. (*Ann. Acad. bras. Sci.*, 30th June 1954, Vol. 26, No. 2, pp. 349–355.) Experiments are described which indicate that application of a field between the electrodes of a capacitor with the dielectric partly in the solid and partly in the liquid state accelerates the phase change in the dielectric. From measurements of the current and calculation of the Joule energy dissipated, it is shown that this energy is several hundred times smaller than the heat necessary for the normal fusion of the corresponding mass of the dielectric.

537.226 : 536.421.1 : 537.29 **1612**

Field-Induced Melting of Dielectrics.—B. Gross. (*Ann. Acad. bras. Sci.*, 30th June 1954, Vol. 26, No. 2, pp. 289–291.) Theory is presented relevant to the phenomena described by Costa Ribeiro (1611 above).

537.311.1 **1613**

Plasma Oscillations in a Periodic Potential: the One-Zone Theory.—J. Hubbard. (*Proc. phys. Soc.*, 1st Dec. 1954, Vol. 67, No. 420A, pp. 1058–1068.) The plasma-oscillation theory of collective electron interactions developed by Bohm & Pines (1375 of 1954 and back references) can be applied to the problem of the conduction electrons in metals by modifying it to take account of the periodic potential present. This modification is carried out, neglecting the interactions of electrons in different zones and assuming that the effect of interzone transitions on the collective behaviour is small enough to be treated by perturbation theory. The main effect of the potential is to alter the effective mass of the electrons.

537.311.31 + 536.212.2 **1614**

The Electrical and Thermal Conductivities of Monovalent Metals.—J. M. Ziman. (*Proc. roy. Soc. A*, 7th Dec. 1954, Vol. 226, No. 1167, pp. 436–454.) "Numerical calculations for the case of sodium, using the Bardeen (1937) formula for the scattering cross-section and Blackman's (1951) value for a 'longitudinal Debye temperature', agree better with observation than do the simple Bloch expressions, but there still remain discrepancies." Further study of the scattering cross-section function might remove these.

537.311.31 + 537.312.62 **1615**

High-Frequency Resistance of Tin and Indium in the Normal and Superconducting State.—C. J. Grebenkemper. (*Phys. Rev.*, 1st. Dec. 1954, Vol. 96, No. 5, pp. 1197–1198.) Further measurements at 24 kMc/s confirm results obtained previously [3060 of 1952 (Grebenkemper & Hagen)].

537.311.31 **1616**

The Physical Nature of a Metal Surface in Conduction Theory.—H. A. Müser. (*Phil. Mag.*, Dec. 1954, Vol. 45, No. 371, pp. 1237–1246.) A discussion is presented in which the reflection of electrons striking the surface from inside is treated as a diffraction phenomenon.

537.5 : 061.3 **1617**

Gaseous Electronics Conference in New York.—F. L. Jones. (*Nature, Lond.*, 22nd Jan. 1955, Vol. 175, No. 4447, pp. 154–155.) Papers presented at the conference held in October 1954 are surveyed briefly. Physics of plasma and ionization processes leading to electrical breakdown were among the subjects discussed.

537.52 **1618**

Study of Gaseous Discharges by Magnetic Resonance.—D. J. E. Ingram & J. G. Tapley. (*Research, Lond.*, Dec. 1954, Vol. 7, No. 12, Supplement, pp. S63–S64.) Measurements are reported which indicate that the technique of magnetic resonance may prove useful for studying the characteristics of low-pressure gas discharges.

537.523.5 : 621.396.822 **1619**

Relaxation Oscillations and Noise from Low-Current Arc Discharges.—M. I. Skolnik & H. R. Puckett, Jr. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 74–79.) Noise measurements were made on arcs, using various electrode materials and gases, over the frequency range 0·1 Mc/s – 4·5 kMc/s. The results for Al electrodes in air are plotted in comparison with the computed spectrum. Pulses generated in the circuit formed by the series limiting resistor and the capacitance across the discharge are considered responsible for most of the noise.

537.525 **1620**

Formative Time of the Cathodic Space Charge.—D. Brini, O. Rimondi & P. Veronesi. (*Nuovo Cim.*, 1st Dec. 1954. Vol. 12, No. 6, pp. 915–922. In English.) A criterion for evaluating the formative time is based on observations of rise time and overshoot in intermittent discharges. Different kinds of intermittent discharges are reviewed.

537.525 **1621**

On Intermittent Discharges in Air at Low Pressure.—D. Brini, O. Rimondi & P. Veronesi. (*Nuovo Cim.*, 1st Dec. 1954, Vol. 12, No. 6, pp. 948–949. In English.) An experimental investigation is reported of the dependence of the discharge frequency on the gas pressure and electrode separation.

537.533 **1622**

Forces between Parallel Electron Streams.—J. Webb. (*Elect. Rev., Lond.*, 31st Dec. 1954, Vol. 155, No. 27, pp. 1037–1038.) A simplified fundamental analysis is presented, taking account of the forces of acceleration, e.s. repulsion, e.m. attraction, gravitation and any local fields. The results indicate that for all electron velocities up to the immediate threshold of the velocity of light the resultant force between parallel electron streams is repulsive.

537.56 **1623**

Spectroscopic Studies of Highly Ionized Argon produced by Shock Waves.—H. E. Petschek, P. H. Rose, H. S. Glick, A. Kane & A. Kantrowitz. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 83–95.)

537.56 **1624**

Kinetic Theory of Weakly Ionized Homogeneous Plasmas: Part 1.—M. Bayet, J. L. Delcroix & J. F. Denisse. (*J. Phys. Radium*, Dec. 1954, Vol. 15, No. 12, pp. 795–803.) A rigorous method is presented for integrating Boltzmann's equation by successive approximations for a weakly ionized gas subjected to an alternating electric field and a static magnetic field. The electron-velocity distribution function is developed with respect to the electric field, and the individual functions obtained are developed as spherical functions. The method is applied to investigation of a Lorentz-type gas. See also 2910 of 1954.

537.56 : 537.311.37 **1625**

Electrical Conductivity of Highly Ionized Argon produced by Shock Waves.—Shao-Chi Lin, E. L. Resler & A. Kantrowitz. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 95–109.)

538.22 **1626**

Antiferromagnetism and Ferrimagnetism of Non-Stoichiometric Compounds.—E. W. Elcock. (*Proc. roy Soc. A*, 21st Dec. 1954, Vol. 227, No. 1168, pp. 102–114.) A simple quantitative treatment is given of the magnetic properties of a substance containing vacancies, enabling the most important magnetic properties of many non-stoichiometric compounds to be interpreted.

538.3 **1627**

Representation of Electromagnetic Fields of Any Frequency using the Energy-Quantum Model.—H. Zuhrt. (*Arch. elekt. Übertragung*, Dec. 1954, Vol. 8, No. 12, pp. 565–577.) Development of theory presented previously (1004 of April). Wave propagation phenomena including reflection, interference and diffraction are explained in terms of the energy-quantum model; static fields are also considered. Voltage, current and characteristic impedance are related to mechanical quantities, and an appropriate system of dimensions and units is presented.

538.561 : 537.533 **1628**

Čerenkov Radiation from Extended Electron Beams.—M. Danos. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 2–7.) Calculations are made of the radiation emitted by bunched beams passing close to dielectric surfaces; both plane and cylindrical geometries are considered. See also *Trans. Inst. Radio Engrs*, Sept. 1954, Vol. MTT-2, No. 3, pp. 21–22.

538.566 : 535.42 **1629**

Calculated Diffraction Patterns of Dielectric Rods at Centimetric Wavelengths.—C. Froese & J. R. Wait. (*Canad. J. Phys.*, Dec. **1954**, Vol. **32**, No. **12**, pp. **775–781**.) Calculations of the field behind the cylinder are made for the case of a normally incident wave with the electric vector (*a*) parallel and (*b*) perpendicular to the cylinder axis. The dielectric materials considered include polystyrene, lucite and tenite. The diffraction pattern is only slightly dependent on the dielectric constant of the rod. Small discrepancies between the calculated values and values obtained experimentally [**3538** of **1954** (Wiles & McLay)] are probably due to resistive loss in the dielectric.

538.569.4 **1630**

Absorption of Microwaves by Oxygen in the Millimeter Wavelength Region.—J. O. Artman & J. P. Gordon. (*Phys. Rev.*, 1st Dec. **1954**, Vol. **96**, No. **5**, pp. **1237–1245**.) An account is given of an experimental investigation of the absorption at high and at low pressure. Theories advanced in explanation of the line-broadening effects are discussed.

538.569.4 **1631**

Spectral Investigations in the Wavelength Range around 1 mm.—L. Genzel & W. Eckhardt. (*Z. Phys.*, 20th Dec. **1954**, Vol. **139**, No. **5**, pp. **578–598**.) A description is given of the construction and method of operation of an infrared-type spectrometer which has been used with thermal radiator and receiver to obtain absorption spectra at wavelengths over 1 mm. The spectrum obtained for water vapour over the range 0·14–1·4 mm is shown as an example. Results obtained with HCN and H_2S are also reported.

538.569.4 : 535.34 : 621.372.413 **1632**

Variable-Frequency Microwave Cavity Spectrometer.—R. J. Collier. (*Rev. sci. Instrum.*, Dec. **1954**, Vol. **25**, No. **12**, pp. **1205–1207**.) Molecular-gas spectra at wavelengths around 10 cm are investigated using a system in which a single coaxial cavity serves as Stark or Zeeman modulation cell and as frequency reference unit.

548.0 : 53 **1633**

Simplified Impurity Calculation.—G. F. Koster & J. C. Slater. (*Phys. Rev.*, 1st Dec. **1954**, Vol. **96**, No. **5**, pp. **1208–1223**.) The methods developed previously (699 of March) are used to investigate the case of a local perturbation in a simple cubic lattice.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **1634**

Abnormal Galaxies as Radio Sources.—B. Y. Mills. (*Observatory*, Dec. **1954**, Vol. **74**, No. **883**, pp. **248–249**.) Results of radio-telescope observations at Sydney indicate that galaxy NGC 1316 is probably a radio source, whereas NGC 1947 is probably not.

523.16 **1635**

Observations of Galactic Radiation on a Wavelength of 33 cm.—J. F. Denisse, É. Leroux & J. L. Steinberg. (*C. R. Acad. Sci., Paris*, 17th Jan. **1955**, Vol. **240**, No. **3**, pp. **278–280**.) Report of measurements made using the Wurzburg mirror at Marcoussis. Results are presented in the form of an isophot map of the galaxy with intensities expressed as apparent temperature in arbitrary units. The 33-cm radiation is attributed principally to ionized hydrogen. A table giving the positions of localized sources includes five thought to have been observed for the first time.

523.16 : 523.72 **1636**

Study of Solar R.F. Radiation on 9 350 Mc/s around Sunset and Sunrise.—I. Kazes & J. L. Steinberg. (*C. R. Acad. Sci., Paris*, 31st Jan. **1955**, Vol. **240**, No. **5**, pp. **493–495**.) Report of measurements made at Paris, using a parabolic mirror of diameter 1·5 m. Graphs are presented showing the variation of refraction with solar angle and quasi-periodic intensity variations observed when the angle of elevation is less than 15°. Attenuation due to absorption by oxygen is observed at angles less than about 20°.

523.16 : 523.72 **1637**

Fine Structure of Solar Radio Transients.—G. Reber. (*Nature, Lond.*, 15th Jan. **1955**, Vol. **175**, No. **4446**, p. **132**.) Brief report of observations made during 1948–1950. Solar bursts observed at 480, 160 and 51 Mc/s were found to be composed of numerous discrete pips with median duration approximately proportional to wavelength. The spectral width of a pip is a few per cent of its mean frequency. The frequency of occurrence of the pips was greatest at 160 Mc/s.

523.16 : 621.396.677 **1638**

Aerial Smoothing in Radio Astronomy.—R. N. Bracewell & J. A. Roberts. (*Aust. J. Phys.*, Dec. **1954**, Vol. **7**, No. **4**, pp. **615–640**.) Theoretical considerations show that the aerial does not register those spatial Fourier components of the true distribution of radio brightness having frequencies beyond a cut-off determined by the aerial aperture. Components of lower frequency are registered but their relative strengths are altered. The consequences are that (*a*) there are invisible distributions which produce no response when scanned by the aerial, and (*b*) in conducting a survey the measuring points must be closer together than half the period of the Fourier component at cut-off.

523.74/.75 **1639**

Prominence Activity (1905–1952).—R. Ananthakrishnan. (*Proc. Indian Acad. Sci.*, Section A, Aug. **1954**, Vol. **40**, No. **2**, pp. **72–90**.) Charts prepared from observations made at Kodaikanal show the salient features of solar prominence activity during the last four sunspot cycles. A preliminary examination suggests that during the maximum phase of the cycle geomagnetic activity shows a better correlation with prominences than with sunspots.

523.752 **1640**

The Emission of Radiation from Model Hydrogen Chromospheres: Part 2.—J. T. Jefferies & R. G. Giovanelli. (*Aust. J. Phys.*, Dec. **1954**, Vol. **7**, No. **4**, pp. **574–585**.) An improved method is presented for calculating the characteristics of the radiation field of Hα, Lα, Lβ, and the Lyman continuum emitted by model hydrogen atmospheres at kinetic temperatures of 10^4–$2{\cdot}5 \times 10^5$ °K. A useful application of the results would be in interpreting observations of prominences and flares.

550.385 **1641**

Qualitative Explanation of the Commencement of Some Polar Magnetic Disturbances based on the Theory of Chapman and Ferraro.—G. Grenet. (*C. R. Acad. Sci., Paris*, 24th Jan. **1955**, Vol. **240**, No. **4**, pp. **448–450**.)

550.385 : 550.375 **1642**

Geomagnetic and Geoelectric Variations.—J. G. Scholte & J. Veldkamp. (*J. atmos. terr. Phys.*, Jan. **1955**, Vol. **6**, No. **1**, pp. **33–45**.) Analysis of records of geomagnetic pulsations, especially those with periods of 10–10^2 sec, indicates that they may be associated with ionospheric vibrations caused by a disturbance of the ionization equilibrium. Information regarding the distribution of ground conductivity is obtained from the relation between the magnetic pulsations and the associated transverse-electric field pulsations.

550.385.25 : 551.510.535 **1643**

The Abnormal Variations of the Horizontal Magnetic Intensity at Huancayo (Peru).—Z. Ibrahim. (*Proc. math. phys. Soc. Egypt*, 1953, Vol. 5, No. 1, pp. 21–24.) The magnetic field of the ionospheric current system arising from lunar atmospheric tidal motion is calculated for various points on the earth's surface. The daily variation of the horizontal component at Huancayo is found to be nearly twice as great as at Batavia, though the latitudes of the two points are nearly the same. Observations at a point between the geographic and magnetic equators in the northern hemisphere should help to explain this anomaly.

550.385.4 : 551.510.535 **1644**

On the World-Wide Disturbance in F_2 Region.—T. Obayashi. (*J. Geomag. Geoelect.*, June 1954, Vol. 6, No. 2, pp. 57–67.) The average disturbance in the value of f_0F_2 during magnetic storms is separated into the storm-time part D_{st} (f_0F_2) and the local-time part $D_s(f_0F_2)$. These were calculated in the cases of 10 typical storms from data obtained from 40 stations in the northern hemisphere. Both their range and phase are correlated with the magnetic activity. The phase of $D_s(f_0F_2)$ during the active stage of the magnetic storm is almost entirely dependent on the local time but after the cessation of activity the disturbance moves with the rotating earth. See also *J. Radio Res. Labs, Japan*, June 1954, Vol. 1, No. 5, pp. 41–50.

550.386 "52" **1645**

An Analysis on the Diurnal Variation of the Terrestrial Magnetism, especially on the Day-Time-Variation of Geomagnetically Quiet Days.—M. Ota. (*J. Geomag. Geoelect.*, June 1954, Vol. 6, No. 2, pp. 83–98.)

551.510.534 **1646**

Vertical Distribution of Atmospheric Ozone at Longyearbyen, Spitzbergen (78°N).—S. H. H. Larsen. (*J. atmos. terr. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 46–49.)

551.510.535 **1647**

The Constitution of the Upper Atmosphere and the Ionosphere Research Station of the Institute of Geophysics at Genoa.—M. Bossolasco & A. Masotto. (*Geofis. Met.*, Sept./Dec. 1954, Vol. 2, Nos. 5/6, pp. 80–86.) An outline of knowledge on the structure and electrical properties of the ionosphere is followed by a description of ionosphere sounding equipment recently put into operation and comprising pulse transmitter for the range 2–15 Mc/s, double-superheterodyne receiver and c.r.o. recorder.

551.510.535 **1648**

Calculation of the Collision Frequency in the Ionosphere.—L. Caprioli. (*R. C. Accad. naz. Lincei*, Dec. 1954, Vol. 17, No. 6, pp. 365–370.) It is shown that, if z_0 is the true reflection height corresponding to ω_0, the lowest frequency of the sounding sweep, and z_E is the true reflection height corresponding to the first critical frequency ω_E greater than ω_0, then provided that the distribution of ion concentration and collision frequency are known for values of z up to z_0 and the absorption is observed over the range $\omega_0 - \omega_E$, the function $\nu(z)$ expressing the height distribution of collision frequency can be determined over the range $z_0 - z_E$ by solving an integral equation due to Abel.

551.510.535 **1649**

Turbulence in the Upper Ionosphere.—A. Maxwell. (*Phil. Mag.*, Dec. 1954, Vol. 45, No. 371, pp. 1247–1254.) "From the experimental data at present available it is shown that the Reynolds number in the upper F region (300–400 km level) is of the order of 300. The region may therefore be turbulent. It is suggested that the high level diffracting screens which give rise to spread F echoes and to radio star fading are caused by non-laminar flow, and that their non-appearance during the daylight hours may be due to the inhibition of turbulence by large temperature gradients, by lower drift velocities, or by an increase in the kinematic viscosity."

551.510.535 **1650**

Motion of Clouds of Abnormal Ionization in the Auroral and Polar Regions.—E. L. Hagg & G. H. Hanson. (*Canad. J. Phys.*, Dec. 1954, Vol. 32, No. 12, pp. 790–798.) A study has been made of unusual types of echo exhibited by film records of rapid-succession sweep observations at several stations in Northern Canada. Three distinct types of echo are identified, probably corresponding to (*a*) horizontally moving E_s clouds, (*b*) clouds descending vertically from the F to the E layer, and (*c*) clouds moving at extremely high velocities in the E layer. Type (*c*) echoes were observed only at stations very close to the auroral zone maximum and may be due to sweeping of the auroral ionizing agent. Type (*b*) echoes also appear to be related to an auroral ionizing agent.

551.510.535 **1651**

Information obtained from Ionization Charts.—R. Eyfrig, E. Harnischmacher & K. Rawer. (*C. R. Acad. Sci., Paris*, 24th Jan. 1955, Vol. 240, No. 4, pp. 446–448.) Ionization charts drawn up monthly for two zones covering (*a*) America and (*b*) Europe, Africa and Asia are discussed. The distributions observed generally confirm the theory of geomagnetic control of the F_2 layer [2898 of 1946 (Appleton)], but some exceptions are observed; there appears to be a lower limiting value for the height of the sun below which the geomagnetic control does not operate. The control is effective at latitudes as high as 70°. Measurements at other times besides midday are required to study the effect. Asymmetry as between northern and southern hemispheres is observed. The north polar zone was studied in detail; the auroral E zone appears to be centred on the geographic pole.

551.510.535 **1652**

Velocity of Movement of Sporadic-E Clouds.—M. R. Kundu. (*Sci. & Cult.*, Dec. 1954, Vol. 20, No. 6, p. 303.) Curves of the diurnal variation of the E_s-layer critical frequency for four Japanese stations indicate a progressive retardation of the time of occurrence of the maximum on passing from the highest-latitude to the lower-latitude stations. A value of about 70 m/s is deduced for the horizontal component of the velocity of the E_s clouds; this is of the same order as the velocity of E-layer winds found by various methods.

551.510.535 **1653**

Interpretation of Measurements on the Ionosphere F_1 layer.—K. Rawer. (*C. R. Acad. Sci., Paris*, 17th Jan. 1955, Vol. 240, No. 3, pp. 331–333.) The maximum-ionization level of the F_1 layer is often located within the lower part of the F_2 layer, so that echo sounding yields a continuous curve for the F_1 and F_2 layers, with a more or less marked maximum or merely a point of inflection indicating the virtual height of the F_1 layer. In consequence, the critical frequency of this layer is not clearly defined. A correction is required, the sign of which depends on the theory accepted for the origin of the F_2 layer. Mohler's theory (1014 of 1941) gives results in good agreement with observations.

551.510.535 **1654**

Lunar Tides in the Ionosphere F_2 Layer at Dakar.—F. Delobeau. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 222–224.) Hourly records of f_0F_2 and $h'F_2$ for the years 1950–1953 have been analysed; maximum variations and times of occurrence of maxima are tabulated for the different seasons. The semidiurnal component is predominant except in summer; during winter the tidal variations of f_0F_2 and $h'F_2$ have amplitudes of ± 0·2 Mc/s and ± 5 km respectively. The phases and amplitudes are considerably different from those observed at other tropical stations; anomalies may be due to the circumstance that the F_2 layer at Dakar is very thick in summer; the ionization maximum occurs at the equinoxes and not in winter.

551.510.535 **1655**

On the Meridional Distribution of the Minimum Virtual Height of the F_2 Layer.—T. Shimazaki. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 15–25.) Results of an analysis of daily variations in $h'F_2$ from 35 observatories indicate the presence of two periodic terms: (*a*) the diurnal variation, which is dependent on the geographic latitude, and (*b*) the semidiurnal variation, which depends on the geomagnetic latitude. The former may be considered as the thermal effect, the latter as the tidal effect in the F_2 region.

551.510.535 **1656**

The Effect of the Solar Tides and the Temperature Change on the Daily Variation in Electron Density and Height of the F_2-Layer.—T. Shimazaki. (*J. Geomag. Geoelect.*, June 1954, Vol. 6, No. 2, pp. 68–82.) The departure Δn_m of the maximum electron density from the norm of a static Chapman region is inversely proportional to the temperature variation, except in the morning when the electron density is small. The semidiurnal variation in Δn_m appears even in the case when account is taken of the diurnal temperature variation only. As regards Δh_m, the departure from the norm of the height of n_m, the result is similar to that obtained by Weiss (1348 of 1953) except that it is more strongly temperature dependent. There is some interaction between the temperature and the tidal effects.

551.510.535 : 523.3 **1657**

Influence of the Moon on the Maximum Ionization of the Ionosphere E Layer.—E. Harnischmacher. (*C. R. Acad. Sci., Paris*, 31st Jan. 1955, Vol. 240, No. 5, pp. 553–555.) An analysis of f_0E variations over a period of four years, observed at six stations, indicates that after taking account of seasonal, solar-cycle and equation-of-time effects, there is evidence of a lunar variation of amplitude 1% centred on the full moon.

551.510.535 : 523.72 **1658**

Soft X Radiation from the Quiet Solar Corona.—G. Elwert. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 637–653.) The mechanisms involved in the production of the soft X rays are discussed, and the significance of this radiation for the formation of the normal ionosphere E layer is indicated. See also 726 of 1954.

551.510.535 : 621.317.3 **1659**

Equipment for the Measurement of Changes of the Phase Path of Ionospheric Echoes.—H. Yuhara, T. Koseki & Y. Aono. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 11–14.) The equipment described is built with units conventional in pulse applications and is developed from that described by Findlay (397 and 404 of 1952). Oscillograms of ground pulse beats and echo patterns of the E and F regions are shown.

551.510.535 : 621.396.11 **1660**

Reflection Conditions for Vertical Propagation in the Ionosphere in the Presence of Collisions and of the Earth's Magnetic Field. Case of the E Layer.—Lepechinsky & Durand. (See 1767.)

551.510.535 : 621.396.11.029.51 **1661**

The Development of an E-Region Model consistent with Long-Wave Phase-Path Measurements.—R. E. Jones. (*J. atmos. terr. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 1–17.) An electron-density model is evolved by modification of the Chapman theory to include the effects of variable scale height, dissociation of O_2, and variable recombination. The model is checked against phase-height data for 150 kc/s and 2·4 Mc/s and against f_0E values.

551.510.535 : 621.396.812 **1662**

Measurement of Attenuation in the Ionosphere.—Ochs. (See 1764.)

551.510.535 : 621.396.812.3 **1663**

The Autocorrelogram of Randomly Fading Waves.—Banerji. (See 1772.)

551.510.535(98) : 621.396.11 **1664**

Statistical Studies of Polar Radio Blackouts.—J. W. Cox & K. Davies. (*Canad. J. Phys.*, Dec. 1954, Vol. 32, No. 12, pp. 743–756.) "A statistical study of high frequency radio blackouts in Canada is made from records taken at several ionosphere sounding stations. Both vertical incidence and communication data are examined to determine the geographical, seasonal, and diurnal distributions of the frequency of occurrence of blackout. It is found that blackouts are most abundant in the morning and that the time of maximum occurrence increases with increasing latitude."

551.578 : 621.396.11 : 621.396.96 **1665**

The Microwave Properties of Precipitation Particles.—K. L. S. Gunn & T.W.R. East. (*Quart. J. R. met. Soc.*, Oct. 1954, Vol. 80, No. 346, pp. 522–545.) "The theory of scattering and attenuation by rain, snow and cloud is reviewed and theoretical results are presented in the form of equations, tables and graphs, so that the radar response to meteorological particles can be calculated at six wavelengths (10, 5·7, 3·2, 1·8, 1·24 and 0·9 cm) and various temperatures. Particular emphasis is placed on developments since Ryde's comprehensive paper in 1946. Published experimental results are compared with the theory. All results computed from the theory are contained in Tables 4 and 5. The attenuation by water vapour and oxygen is given in an Appendix."

551.594.6 **1666**

An Attempt to observe Whistling Atmospherics near the Magnetic Equator.—J. R. Koster & L. R. O. Storey. (*Nature, Lond.*, 1st Jan. 1955, Vol. 175, No. 4444, pp. 36–37.) According to the theory of Barkhausen and Eckersley, the mode of propagation of whistling atmospherics is such that they should not occur near the magnetic equator. A report is given of observations made at Achimota, over the period from December 1951 to March 1954; no whistlers were detected, though other types of atmospheric were frequent.

LOCATION AND AIDS TO NAVIGATION

621.396.93 : 551.594.6 **1667**

Low-Frequency Direction Finder.—C. Clarke & V. A. W. Harrison. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 109–114.) A more detailed account of the instrument described previously [3226 of 1954 (Horner)].

621.396.933 **1668**

Radio Installations of the Danish Airways System.—K. Svenningsen. (*Teleteknik, Copenhagen*, Dec. 1954, Vol. 5, No. 4, pp. 391–400.) The navigation aids and communication systems used are described.

621.396.96 : 551.578 : 621.396.11 **1669**

The Microwave Properties of Precipitation Particles.—Gunn & East. (See 1665.)

621.396.962.33 **1670**

Radar Receiver with Elimination of Fixed-Target Echoes.—H. Tanter. (*Elect. Commun.*, Dec. 1954, Vol. 31, No. 4, pp. 235–248.) English version of paper abstracted in 2407 of 1954.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **1671**

Design and Operation of Evapor-ion Pumps.—R. H. Davis & A. S. Divatia. (*Rev. sci. Instrum.*, Dec. 1945, Vol. 25, No. 12, pp. 1193–1197.) Operation of the pump described depends on the gettering action of continuously evaporated Ti in conjunction with ion pumping. The lowest pressure attainable is about 2×10^{-7} mm Hg. The dependence of pumping speed on the temperature of the gettering surface, the pressure, and the rate of evaporation of Ti is investigated.

535.215 : 537.311.33 : 546.817.23 **1672**

Response Time of Photoconductivity of Lead Selenide.—L. Sosnowski & M. Chmielewski. (*Bull. Acad. polon. Sci.*, Classe 3, 1953, Vol. 1, Nos. 3/4, pp. 119–121. In English.) An oscillographic method for investigating response times of less than 1 μs is described. An exponential timebase is used and the specimen is illuminated in synchronism by light pulses at repetition rates up to 50 000/sec. The response times of three different PbSe cells were 0·25, 0·35 and 0·9 μs within $\pm$ 0·1 μs, their respective resistances and sensitivities being 23, 51, and 100 kΩ, and 12, 15, and 40 arbitrary units.

535.215 : 537.311.33 : 546.817.23 **1673**

Photoconductive and Photovoltaic Layers of Lead Selenide.—H. Checińska. (*Bull. Acad. polon. Sci.*, Classe 3, 1953, Vol. 1, Nos. 3/4, pp. 123–125. In English.) The method of preparing PbSe layers exhibiting these effects is described and some results of determinations of limiting sensitivity and spectral sensitivity in the range 0·5–3·6 μ are given. At room temperature the sensitivity to radiation from an ordinary incandescent lamp is less than one tenth that of PbS.

535.37 **1674**

The Shape of the Emission Bands of Luminescent Solids.—C. C. Vlam. (*Brit. J. appl. Phys.*, Dec. 1954, Vol. 5, No. 12, pp. 443–446.)

535.37 **1675**

Luminescence in High Polymers.—H. Hinrichs. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 617–630.) An investigation of organic phosphors embedded in polystyrol.

535.37 : 537.311.33 **1676**

Temperature Dependence of the Energy-Gap in ZnS.—C. Z. van Doorn. (*Physica*, Dec. 1954, Vol. 20, No. 12, pp. 1155–1156.) Measurements on a single crystal showed that the temperature variation of the energy gap varied between $4{\cdot}6 \times 10^{-4}$eV/°K at 77°K and $8{\cdot}5 \times 10^{-4}$eV/°K at 800°K.

535.376 **1677**

The Edge Emission of ZnS, CdS and ZnO and its Relation to the Lattice Vibrations of these Solids.—F. A. Kröger & H. J. G. Meyer. (*Physica*, Dec. 1954, Vol. 20, No. 12, pp. 1149–1156.)

535.376 : 538.615 **1678**

The Effect of Intense Magnetic Fields on Electroluminescent Powder Phosphors.—A. N. Ince. (*Proc. phys. Soc.*, 1st Dec. 1954, Vol. 67, No. 420B, pp. 870–874.) No quenching of electroluminescence was observed in phosphors in magnetic fields of up to $1{\cdot}3 \times 10^5$ oersted. This is contrary to the predictions of Destriau (110 of 1949). The significance of this result is discussed.

537.226 **1679**

High-Frequency Polarization of a Spherical Body and of an Assemblage of Particles of a Perfect Dielectric.—A. Colombani. (*C. R. Acad. Sci., Paris*, 31st Jan. 1955, Vol. 240, No. 5, pp. 503–505.) Analysis is given for a single particle, using Maxwell's equations in spherical-coordinate form. If the permittivity is real and very high the electric field and e.s. energy within the particle may become very large. An expression is derived for the apparent susceptibility of an assemblage of the particles.

537.227 : 546.431.824-31 **1680**

Observation of Paramagnetic Resonances in Single Crystals of Barium Titanate.—A. W. Hornig, E. T. Jaynes & H. E. Weaver. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, p. 1703.)

537.311.33 **1681**

A Possible Mechanism of the Scattering of Current Carriers in Semiconductors.—T. A. Kontorova. (*Zh. tekh. Fiz.*, Dec. 1954, Vol. 24, No. 12, pp. 2217–2220.) The usual form of the temperature dependence of the mobility of current carriers for certain semiconductors has not yet been satisfactorily explained. By taking account of the interaction of the current carriers not only with acoustic vibrations of the lattice but also with optical vibrations which are possible when the adjacent particles vibrate in opposite phase, the theoretical results are brought into agreement with experiment.

537.311.33 **1682**

Use of *p-n* Junctions for Solar Energy Conversion.—E. S. Rittner. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1708–1709.) Calculations of the efficiency to be expected from a Si cell lead to results in agreement with those of Cummerow (145 of January), except that for maximum power conversion efficiency the energy gap of the semiconductor should be about 1·5–1·6 eV; thus AlSb is preferable to Si in this respect.

537.311.33 **1683**

Determination of the Optical Constants of Type-$A^{III}B^{V}$ Semiconductors at Infrared Wavelengths.—F. Oswald & R. Schade. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 611–617.) Reflection and transmission measurements were made on a series of compounds of elements of Groups III and V of the periodic system, at wavelengths from 0·8 to 15·2 μ. Values found for absorption constant, refractive index and width of energy gap are tabulated; energy-gap values determined by other workers, using electrical methods, are given for comparison.

537.311.33 **1684**

Theory of Conduction in Isotropic Semiconductors.—O. Madelung. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 667–674.) The classical theory is developed and the equations for electrical and thermal current density are established. From these equations the coefficients of all the galvanomagnetic, thermoelectric and thermomagnetic effects are derived. Expressions for these coefficients are tabulated for small values of magnetic field strength, for degenerate and nondegenerate semiconductors with given scattering mechanism.

537.311.33 : 537.323 **1685**

Theory of the Thermoelectric Power of Semiconductors.—C. Herring. (*Phys. Rev.*, 1st Dec. 1954, Vol. 96, No. 5, pp. 1163–1187.) The marked rise of thermoelectric power which has been observed in some semiconductors at temperatures below room temperature [1093 of 1954 (Frederikse)] has been attributed to the effect of thermal lattice vibrations, the total thermoelectric power being composed of an electron term and a phonon term. This theory is developed; the results are supported by experimental data on Ge.

537.311.33 : 546.23 **1686**

Crystallization of Selenium under Pressure.—D. N. Nasledov & P. T. Kozyrev. (*Zh. tekh. Fiz.*, Dec. 1954, Vol. 24, No. 12, pp. 2124–2135.) The effect of pressure up to 4 000 atm was investigated. Pressure retards crystallization at low temperatures (below 110°C) and accelerates it at high temperatures (above 170°C). A curve shows the relation between temperature and pressure at the point of fusion. Large single crystals (up to 5 mm) were formed from liquid Se under pressure. The electrical properties of the crystallized material were investigated. Possible mechanisms explaining the observed phenomena are discussed.

537.311.33 : 546.24 **1687**

Tellurium Single Crystals prepared by the Czochralski Process.—J. Weidel. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, p. 697.)

537.311.33 : [546.28 + 546.289 **1688**

Theory of Donor and Acceptor States in Silicon and Germanium.—C. Kittel & A. H. Mitchell. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1488–1493.) The applicability of the Wannier equation to the donor states in Si and Ge is examined with particular reference to the multiple energy minima in the conduction band. The theory is extended to include degenerate bands, and it is shown that the Wannier equation is to be replaced by a set of coupled wave equations. The theory is also applied to acceptor states. Theoretical and experimental results are in fair agreement for both donors and acceptors.

537.311.33 : 546.28 **1689**

Single Crystals and *p-n* Stratified Crystals of Silicon.—H. Kleinknecht & K. Seiler. (*Z. Phys.*, 20th Dec. 1954, Vol. 139, No. 5, pp. 599–618.) Measurements are reported on specimens produced as described previously [422 of 1953 (Kleinknecht)]. The voltage dependence of the capacitance of the *p-n* specimens indicates a linear variation of impurity-centre concentration. The diffusion voltages and the slope of the forward characteristic are not consistent with a carrier concentration conforming to the Boltzmann law at the boundary layer. The backward currents do not fit Shockley's theory; the discrepancy is explained by assuming the presence of traps acting as recombination centres. The concentration and effective cross-section of these is evaluated from the increase of capacitance at low frequencies.

537.311.33 : 546.28 : 621.314.7 **1690**

Electronic Behaviour of Certain Grain Boundaries in Perfect Crystals.—H. F. Mataré. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, p. 698.) Some experiments are reported on the effect of incorporating structural inhomogeneities in semiconductor crystals; grain boundaries with highly nonlinear resistance were studied. A current gain of 50 was obtained with a three-electrode arrangement using a 5-Ω.cm Si specimen. A practical form of grain-boundary transistor is illustrated.

537.311.33 : 546.289 **1691**

The Production of Germanium from Zinc Residues.—(*Metallurgia, Manchr*, Dec. 1954, Vol. 50, No. 302, pp. 277–278.) Some details are given of methods used in industry and in laboratory assay work for extraction of Ge and for the preparation of the metal. A different recovery scheme is required for each different complex residue. Poison hazards are mentioned.

537.311.33 : 546.289 **1692**

An Observation of Circular Patterns in the Vicinity of Small-Area Alloyed Germanium *p-n* Junctions.—N. Holonyak, Jr. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 121–123.) Rings observed on the crystal surface in the neighbourhood of small alloyed junctions are explained in terms of the action of bubbles accompanying the etching process.

537.311.33 : 546.289 **1693**

Optical Studies of Injected Carriers: Part 3—Infrared Absorption in Germanium at Low Temperatures.—R. Newman. (*Phys. Rev.*, 1st Dec. 1954, Vol. 96, No. 5, pp. 1188–1190.) Measurements are reported which confirm that carriers produced by injection and by impurity doping produce the same absorption effect. Anomalies observed in samples containing Fe may be due to trapping effects. Part 2: 1084 of 1954.

537.311.33 : 546.289 **1694**

A Photoelectric Method for the Simultaneous Determination of Lifetime and Mobility of Injected Current Carriers in Semiconductors.—G. Adam. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 607–611.) Additional carriers are formed by illumination with an elongated spot of light which is swept along the specimen. A probe in the vicinity of the illuminated region picks up a voltage proportional to the additional carrier concentration; this is recorded oscillographically. Methods of evaluating the oscillograms are described and illustrated by examples. Carrier lifetime and diffusion constant can be determined from a single oscillogram. Results are presented for Ge specimens containing various impurities.

537.311.33 : 546.289 **1695**

Determination of the Relation between Mobility and Diffusion Coefficient for Photo-holes in *n*-Type Germanium.—S. M. Ryvkin. (*Zh. tekh. Fiz.*, Dec. 1954, Vol. 24, No. 12, pp. 2136–2149.) Detailed report of an experimental investigation of the diffusion and drift of photoelectrically produced holes. The results confirm the theoretical prediction that Einstein's formula (1) relating mobility to diffusion coefficient applies in this case. The stationary distribution of minority carriers in a partially illuminated semiconductor is discussed in an appendix.

537.311.33 : 546.289 **1696**

Resistivity and Hall Effect of Germanium at Low Temperatures.—C. S. Hung & J. R. Gliessman. (*Phys. Rev.*, 1st Dec. 1954, Vol. 96, No. 5, pp. 1226–1236.) Report of an extensive experimental investigation at temperatures from room temperature to that of liquid He. Anomalies in the Hall-constant curves at low temperature are explained on the assumption of small but finite mobility of carriers in the impurity states; the contribution of these carriers to the total conduction becomes important at low temperature because the concentration of carriers in the conduction band is then very low.

537.311.33 : 546.289 **1697**

Transverse Hall and Magnetoresistance Effects in *p*-Type Germanium.—R. K. Willardson, T. C. Harman & A. C. Beer. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1512–1518.) Calculations based on modification of the two-band model to take account of a small number of high-mobility holes give values for the magnitude, temperature dependence and magnetic-field dependence of Hall and magnetoresistance effects in good agreement with experimental results. The importance of making measurements both at large and small magnetic-field strengths is indicated.

537.311.33 : 546.431-31 : 535.215 **1698**

Ultraviolet Absorption in Barium Oxide Films.—K. Okumura. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1704–1705.) Measurements are reported briefly; results are compared with those of Tyler & Sproull (148 of 1952).

537.311.33 : 546.48.241.1 **1699**

Semiconducting Cadmium Telluride.—D. A. Jenny & R. H. Bube. (*Phys. Rev.*, 1st Dec. 1954, Vol. 96, No. 5, pp. 1190–1191.) In general, *n*-type specimens are obtained by adding Group-III or Group-VII impurities and *p*-type by adding Group-I or Group-V, the activation energies of the *p*-type impurities being much larger than those of the *n*-type impurities. The intrinsic energy gap is about 1·45 eV. Electron and hole mobilities are at least 30 cm/s per V/cm.

537.311.33 : 546.482.21 : 535.215 **1700**

Determination of Trap Distribution from Interrupted-Illumination Measurements on Photoconductive Cadmium Sulphide Single Crystals.—E. A. Niekisch. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 700–701.)

537.311.33 : 546.682-31 **1701**

Investigations of Electrical and Photoelectric Conductivity of Thin Films of Indium Oxide.—G. Rupprecht. (*Z. Phys.*, 20th Dec. 1954, Vol. 139, No. 5, pp. 504–517.) The conductivity of thin films of the *n*-type semiconductor In_2O_3 is markedly dependent on the surrounding atmosphere. Specimens prepared by evaporating In on to a quartz plate and heating in air at 700°–1 000°C had thicknesses between 50 and 250 mμ and conductivities between 10 and 10^{-5} $(\Omega.\text{cm})^{-1}$. Measurements are reported of the temperature variation of conductivity and of the effect of an oxygen atmosphere. Above 500°C a balance is reached between the concentration of impurity centres and the external oxygen concentration. The photoelectric conductivity exhibits an irreversible increase in vacuum.

537.311.33 : 546.682.231 **1702**

Electrical and Optical Properties of Indium Selenide.—R. W. Damon & R. W. Redington. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1498–1500.) Measurements mainly on single crystals are reported. The optical absorption edge was not sufficiently well defined for the energy gap to be estimated unambiguously. The photoconductive response was mostly in the visible region, the sensitivity being comparable with that of grey Se. Attempts to determine the carrier type gave conflicting results; the material may not be a single-carrier-type semiconductor, at least within the surface region.

537.311.33 : 546.86 : 539.234 **1703**

Fermi Level in Amorphous Antimony Films.—E. Taft & L. Apker. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1496–1497.) Photoelectric experiments are reported which confirm that the amorphous form of Sb common in thin evaporated films is a semiconductor with Fermi level about 0·1 eV above the occupied band.

538.221 **1704**

Investigations of Irreversible Magnetization and After Effect.—J. Kranz. (*Z. Phys.*, 20th Dec. 1954, Vol. 139, No. 5, pp. 619–637.) An experimental arrangement is described for measuring the Barkhausen jumps, produced on reversing the field applied to a ferromagnetic specimen, by amplitude-analysing and counting the pulses induced in a solenoid. Results for various materials are presented and discussed.

538.221 **1705**

Large Magnetic Kerr Rotation in BiMn Alloy.—B. W. Roberts & C. P. Bean. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1494–1496.) Brief illustrated note on observations of ferromagnetic domain patterns in large grains of BiMn.

538.221 **1706**

Kinetics of Magnetization in Some Square Loop Magnetic Tapes.—C. P. Bean & D. S. Rodbell. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 124–125.) Curves showing flux reversal characteristics for permalloy tapes are discussed in relation to the domain-wall processes.

538.221 **1707**

The Effect of Particle Shape Variations on the Coercivity of Iron-Oxide Powders.—W. P. Osmond. (*Proc. phys. Soc.*, 1st Dec. 1954, Vol. 67, No. 420B, pp. 875–882.) Calculations show that a Gaussian distribution of particle shape factors about an observed mean value can satisfactorily explain the difference between measured values of coercivity of dispersed magnetic powders and the theoretical values for assemblages of identical particles.

538.221 : 621.318.134 : 537.311.33 **1708**

The Nature of the Insulating Layers in Ferromagnetic Semiconductors.—R. Parker. (*Physica*, Dec. 1954, Vol. 20, No. 12, pp. 1314–1315.) Recent experimental results [3604 of 1954 (Volger)] can be explained on the following assumptions: (*a*) that the appearance of spontaneous magnetization is the cause of the deviation from the normal relation between resistivity and temperature, and (*b*) that the insulating layer may be identified with the region in the material that is not spontaneously magnetized.

538.221 : 621.318.134 **1709**

Saturation Magnetization and Crystal Chemistry of Ferrimagnetic Oxides.—E. W. Gorter. (*Philips Res. Rep.*, Aug.–Dec. 1954, Vol. 9, Nos. 4–6, pp. 295–320, 321–365 & 403–443.) A thesis in which measurements of saturation magnetization, σ, against temperature, T, are reported for various mixed crystal oxides with spinel structure. Results are in agreement with Néel's theory: some of the anomalous σ/T curves predicted have been found. Single ferrites investigated of the type $Me^{II}Fe_2{}^{III}O_4$ belong to a group with complete parallelism of the ionic moments inside each sublattice; mixed crystals of the type $Me_{1-a}Zn_aFe_2O_4$ with $a > 0{\cdot}4$ belong to a group with angles between the ionic moments inside one of the sublattices; for $Ca_{0{\cdot}35}Zn_{0{\cdot}65}Fe_2O_4$ the magnetic moment is higher than that of any MgZn ferrite; this is discussed with reference to Anderson's theory. Other materials investigated are ferrimagnetic spinels containing Ti and Al, and ferrimagnetic oxides containing Cr.

538.221 : 621.318.134 **1710**

Low-Temperature Acoustic Relaxation in Ni-Fe Ferrites.—M. E. Fine & N. T. Kenney. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1487–1488.) "An acoustic relaxation effect occurs near 40°K in $Ni_{0{\cdot}75}Fe_{2{\cdot}25}O_4$ and is attributed to a stress-induced change in distribution of Fe^{++} and Fe^{+++} similar to that occurring in magnetite. The process involves electron diffusion. The activation energy is between 0·026 and 0·055 eV per electron jump."

538.221 : 621.318.134 **1711**

Magnetic and Crystalline Behavior of Certain Oxide Systems with Spinel and Perovskite Structures.—L. R. Maxwell & S. J. Pickart. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1501–1505.) Experiments are reported in which nonmagnetic trivalent ions were substituted for Fe^{3+} in Ni ferrites.

538.221 : 621.318.134 **1712**

Conference on Ferrites, Leningrad, 1st–5th February 1954.—(*Bull. Acad. Sci. U.R.S.S., sér. phys.*, May/June & July/Aug. 1954, Vol. 18, Nos. 3 & 4, pp. 307–416 & 419–520.) The text is presented of more than 20 papers covering theoretical and experimental investigations; subjects discussed include Faraday effect at centimetre wavelengths and temperature dependence of electrical properties of ferrites.

538.221 : 681.142 **1713**

Magnetic Materials for Digital-Computer Components: Part 1—A Theory of Flux Reversal in Polycrystalline Ferromagnetics.—N. Menyuk & J. B. Goodenough. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 8–18.) Output-voltage waveforms of computer storage elements are consistent with the assumption that the flux reversal is attributable to the creation and growth of 180° Bloch walls. A switching coefficient is defined having one component dependent on eddy current and another depending on spin relaxation; for ferrites and thin metal tapes the first of these components is much smaller than the latter. Consideration of various parameters involved indicates that it is better to produce hysteresis-loop squareness by grain orientation or magnetic anneal than by application of external stress or variation of chemical composition.

538.23 **1714**

A Relation between Hysteresis Coefficient and Permeability: Part 2—Further Experimental Results.—M. Kornetzki. (*Z. angew. Phys.*, Dec. 1954, Vol. 6, No. 12, pp. 547–550.) The investigation on ferrites reported earlier (756 of 1953) was extended to cover permanent magnets and various Fe, Fe-Si, Fe-Si-Al and Ni-Fe alloys with initial permeability, μ, between 1·25 and 120 000 and hysteresis coefficient, h, between 0·65 and 9 000 000 cm/kA. A double-logarithmic plot of $h/(\mu - 1)$ against $(\mu - 1)$ shows that the points for most of the materials lie between a pair of parallel lines of slope 1·15 and separation, measured on the $h/(\mu - 1)$ scale, corresponding to a ratio of 40. All groups, except the Fe and Fe-Si alloys, include low-hysteresis materials for which $h/(\mu - 1) \approx 3$ cm/kA. Values of μ and h are tabulated for over 40 materials, and graphs are plotted relating $(\mu - 1)$ to h, $h/(\mu - 1)$, and $h/(\mu - 1)^2$.

621.315.613.1 : 537.529 **1715**

Phenomena preceding Dielectric Breakdown in Mica.—B. Fallou. (*Rev. gén. Élect.*, Nov. 1954, Vol. 63, No. 11, pp. 643–653.) Report of an experimental investigation. Oscillograms are reproduced and discussed in relation to charge conditions at the surfaces of separation in the mica.

621.315.616 : 537.226 **1716**

Dielectric Breakdown of Thermosetting Laminates.—N. A. Skow. (*Mod. Plast.*, Dec. 1954, Vol. 32, No. 4, pp. 152..240.) A report is presented on short-time and endurance tests on laminates bonded with phenolic resin. The grades tested included three based on paper and one each on asbestos, cotton fabric, glass and nylon. The variation of the dielectric strength with temperature, direction of applied field, thickness of laminae and conditioning of the specimens is tabulated and some results are also presented graphically. The most suitable grades for use under various conditions (e.g. high humidity) are indicated.

621.315.614.4 **1717**

Forest Products Research Special Report No. 8. The Dielectric Properties of Wood. [Book Review]—R. F. S. Hearmon & J. N. Burcham. Publishers: H. M. Stationery Office, London, 1954, 19 pp., 1s. 6d. (*Elect. Times*, 9th Dec. 1954, Vol. 126, No. 3292, p. 848.) An investigation of the influence of grain direction, density and moisture content on the permittivity and loss tangent of 12 species of wood over the frequency range 2 kc/s–60 Mc/s is reported.

MATHEMATICS

517.5 **1718**

The Approximation to a Characteristic Function by its Fourier Series.—D. Dugué. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 151–152.)

517.512.2 **1719**

Moving-Strip Fourier Analyzer.—H. J. Grenville-Wells. (*Rev. sci. Instrum.*, Dec. 1954, Vol. 25, No. 12, pp. 1156–1161.) A modified form of the device described by Robertson (*Phil. Mag.*, Jan. 1936, Vol. 21, No. 138, pp. 176–187). Two-dimensional and three-dimensional summations can be performed.

517.564.3 **1720**

The Asymptotic Expansion of Bessel Functions of Large Order.—F. W. J. Olver. (*Phil. Trans. A*, 28th Dec. 1954, Vol. 247, No. 930, pp. 328–368.)

517.9 **1721**

The Asymptotic Solution of Linear Differential Equations of the Second Order for Large Values of a Parameter.—F. W. J. Olver. (*Phil. Trans. A*, 28th Dec. 1954, Vol. 247, No. 930, pp. 307–327.)

519.272.119 **1722**

Qualitative Evaluation of Correlation Coefficients from Scatter Diagrams.—T. M. Burford. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 56–57.) Analysis shows that the result previously obtained by Sugar (2457 of 1954) for the case of a Gaussian distribution can be applied to any distribution.

MEASUREMENTS AND TEST GEAR

621.3.018.41(083.74) + 621.396.91 **1723**

Standard Frequency Transmissions.—L. Essen. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 173–178.) Discussion on 3289 of 1954.

621.3.018.41(083.74) **1724**

Standard Frequency Transmission Equipment at Rugby Radio Station.—H. B. Law. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 166–173. Discussion, pp. 173–178.) "The transmissions are controlled by one of three highly stable oscillator-clock chains, which are checked daily in terms of a frequency standard, and are continuously intercompared in order that instability may be quickly detected. Automatic shut-down features are incorporated to reduce the risk of broadcasting incorrect frequencies under fault conditions. The vital parts of the equipment are protected against mains failure. The transmitted frequencies are normally kept within 1 part in 10^8 of the currently-assessed nominal frequency, based on predicted clock performance, so as to keep within a tolerance of ± 2 parts in 10^8 in terms of finally-corrected time determinations. Day-to-day frequency variations are usually less than ± 2 parts in 10^9."

621.3.018.41(083.74) : 621.317.761 **1725**

The Standard Frequency Monitor at the National Physical Laboratory.—J. McA. Steele. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 155–165. Discussion, pp. 173–178.) Description of equipment for the automatic measurement and recording of the MSF standard frequency transmissions on 60 kc/s, 2·5 Mc/s, 5 Mc/s and 10 Mc/s and of the Droitwich 200-kc/s transmission. The measurements on Droitwich and on MSF 60 kc/s are made by an extension of the established method for intercomparison of the N.P.L. frequency standards; the standard deviations for measurements lasting a few seconds are 3–4 parts in 10^9 and 2–3 parts in 10^9 respectively. "Measurements of the phase of the 1 c/s pulse modulation on MSF 60 kc/s can be made with very high precision. In daily comparisons, the scatter of a group of 60 readings does not usually exceed 30 μs. By a process involving frequency changing by continuous phase shifting, the received frequencies of MSF 2·5 and 5 Mc/s are recorded on a frequency meter of range ± 1 c/s, the discrimination being 2 parts and 1 part in 10^8 at these frequencies, respectively. The records obtained show well-defined diurnal variations on 2·5 Mc/s, particularly at sunrise, where the deviations may amount to several parts in 10^7. The received frequency of 5 Mc/s is subject to continuous variations over a range of about 1 part in 10^7 during daylight hours; in darkness larger changes are recorded."

621.3.018.41(083.74) : 621.373.4.029.5 **1726**

Quartz Resonator Servo: a New Frequency Standard.—N. Lea. (*Marconi Rev.*, 3rd Quarter 1954, Vol. 17, No. 114, pp. 65–73.) The response to an applied oscillator signal of a bridge detector circuit including a quartz crystal resonator is used to control a servodrive-operated variable capacitor in the oscillator tuned circuit. In an experimental instrument, using a 5-Mc/s crystal, frequency variations were reduced to less than 1 part in 10^{10} for variations of + 20% in the applied h.v., a l.v. change from 5 to 6 V, or an oscillator capacitance change which would, if uncorrected, cause a change of 200 parts in 10^{10}. A rate of frequency correction of 1 part in 10^9 per sec was easily achieved. The circuit diagram given is briefly commented on. Experimental results are presented graphically.

621.3.018.41(083.74) : 621.396.82 **1727**

Effect of Interference by Other Standard-Frequency Transmissions upon the Accuracy of Frequency Calibration by a Standard-Frequency Transmission.—K. Matsumoto, T. Nagatake & Y. Suguri. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 41–48.) Experimental results indicate that interference with the JJY standard-frequency transmissions by station WWVH has a negligible effect on the accuracy of frequency calibrations when the reference beat method is used.

621.3.018.41(083.74) : 621.396.91 **1728**

An Experiment on the Types of Time Signals superposed on the Standard-Frequency Transmission.—K. Matsumoto & T. Nagatake. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 49–56.) Coding of a JJY standard-frequency transmission by a 20-ms interruption of the 1-kc/s tone each second and a 200-ms interruption each minute, was compared with coding by the C.C.I.R. method of substituting a 1·4-kc/s tone for 5 ms each second. Using simple receivers at 1 000 km from the transmitter, the former method was found to be the more suitable one.

621.316.84(083.74) **1729**

A 1–100-Ω Build-up Resistor for the Calibration of Standard Resistors.—B. V. Hamon. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, pp. 450–453.) A build-up resistor circuit developed at the Australian National Standards Laboratory comprises 10-Ω manganin resistors in series-parallel. The estimated accuracy when used as a ratio device is of the order of 1 part in 10^8. Test results are tabulated and the construction is illustrated.

621.317.3 : 621.315.61 **1730**

Measurements of Electrical Polarization in Thin Dielectric Materials.—R. W. Tyler, J. H. Webb & W. C. York. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 61–68.) A method suitable for measuring electrical effects such as are produced in film moving over a roller system consists in arranging the dielectric material in contact with a grounded metal backing plate and placing a field meter at a short distance in front of the dielectric. Tests made with a short strip of cellulose acetate film without the emulsion coating are described.

621.317.321 : 538.632 **1731**

Apparatus for Measurement of Hall Effect and Magnetic Change of Resistance with Alternating Current.—K. A. Müller & J. Wieland. (*Helv. phys. Acta*, 31st Dec. 1954, Vol. 27, No. 7, pp. 690–696. In English.) The null method described is operated at 73 c/s and is suitable for detecting voltage changes down to 2 × 10^{-8} V in specimens of resistance between 10^{-5} and 10^2 Ω. The p.d. across the specimen or the Hall e.m.f. is determined by compensating it by an equal and opposite voltage derived from a fixed resistor in series with the specimen. The null detector comprises an amplifier, filter, phase discriminator and an indicator instrument which is either a c.r.o. or an aperiodically damped galvanometer.

621.317.331 : 621.385.2 **1732**

A Method for recording Logarithmic Variations of Resistance.—H. A. Vodden. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, pp. 475–476.) A simple circuit of an ohm-meter recording resistance logarithmically is based on the fact that the logarithm of the anode current of a diode is proportional to the anode voltage over a range of negative voltage values. The useful range of the instrument described is between about 2×10^2 and $10^9\,\Omega$.

621.317.336 : 621.317.755 **1733**

Visual Impedance-Matching Equipment.—R. Dalziel & A. Challands. (*Wireless Engr*, April 1955, Vol. 32, No. 4, pp. 99–107.) A c.r.o. method is described for indicating the degree of match between a load and a cable as, e.g. in aerial feeding. The test oscillator is mechanically swept over the whole frequency range of 80–250 Mc/s. The oscilloscope face is calibrated in terms of s.w.r. Impedance measurements made with the equipment have yielded results in good agreement with those obtained by other methods. See also 2852 of 1948 (Libby).

621.317.361 : 621.385.029.65 **1734**

Cold Measurements of 8 mm Magnetron Frequency and Pulling Figure.—Barrington. (See 1839.)

621.317.382 : 538.632 : 537.311.33 **1735**

The Application of the Hall Effect in a Semiconductor to the Measurement of Power in an Electromagnetic Field.—H. E. M. Barlow. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 179–185. Discussion, pp. 199–203.) Analysis shows that the mean value in time of the Hall e.m.f. is a direct measure of the power traversing the semiconductor in steady or varying fields. Residual rectifier effects are eliminated by operating with a strong magnetic field. Various types of wattmeter embodying the principle are described. Experiments with an *n*-type Ge crystal mounted between the inner and outer conductors of a coaxial line indicate that the Hall effect is approximately the same at 50 c/s and at 300 Mc/s, so that instruments for use at high frequencies can be calibrated at low frequency.

621.317.443 **1736**

An Improved Precision Permeameter.—C. D. Mee & R. Street. (*Proc. Instn elect. Engrs*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 639–642.) A modified form of the d.c. permeameter described by Armour et al. (3499 of 1952) uses a saturable-inductor type of field-measuring device to give automatic and continuous indication of the required compensating-coil current at all points on the B/H curve. Values of H from 10^{-3} oersted upward can be measured.

621.317.715 : 621.383.2 **1737**

Photodianode and Galvanometer Feedback.—L. Deloffre, É. Pierre & J. Roig. (*C. R. Acad. Sci., Paris*, 3rd Jan. 1955, Vol. 240, No. 1, pp. 59–61.) Analysis is presented relevant to galvanometer measurements using the twin-anode photocell device previously described (2543 of 1954 and back reference) in a feedback arrangement. The galvanometer sensitivity can be multiplied by a factor as great as 10 in this way.

621.317.72 : 621.3.018.3 **1738**

Two-Frequency Waveforms: Effects on Rectifier Instruments.—J. E. Parton & W. D. Sutherland. (*Trans. Soc. Instrum. Technol.*, Dec. 1954, Vol. 6, No. 4, pp. 147–161.) Asymmetrical waveforms resulting from the presence of even harmonics are included in this study. For a waveform with two frequency components, a voltmeter with full-wave metal rectifier is found to read within 2% of the value calculated on the assumption of perfect rectification. The mean value differs from that given by a r.m.s. instrument in being dependent on the relative phase of the two components.

621.317.733 : 621.317.4 **1739**

Mutual Inductance Bridge and Cryostat for Low-Temperature Magnetic Measurements.—R. A. Erickson, L. D. Roberts & J. W. T. Dabbs. (*Rev. sci. Instrum.*, Dec. 1954, Vol. 25, No. 12, pp. 1178–1182.)

621.317.755 : 621.314.7 **1740**

An Alpha Plotter for Point-Contact Transistors.—T. P. Sylvan. (*Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, pp. 1094–1098.) Description, with detailed parts list, of a c.r.o. test set.

621.317.78.029.5/.64 **1741**

Broadband R.F. Power Meters.—I. Strauss. (*Radio-Electronic Engng*, Dec. 1954, Vol. 23, No. 6, pp. 10–11, 36.) Equipment for measuring average r.f. power from 5 μW to 5 W in the frequency range 20 Mc/s to 10 kMc/s is briefly described; three frequency sub-ranges are covered by separate instruments. The energy dissipated in a bolometer element in a Wheatstone bridge is kept constant by (*a*) varying the d.c. current through it, and (*b*) attenuating the r.f. energy.

621.317.78.029.65 **1742**

A Calorimeter for Power Measurements at Millimeter Wavelengths.—W. M. Sharpless. (*Trans. Inst. Radio Engrs*, Sept. 1954, Vol. MTT-2, No. 3, pp. 45–47.) Description of an instrument suitable for measuring power of the order of 1 mW, in which equal temperature rises are produced in two waveguide-section power absorbers, one of which is heated by d.c. and the other by the r.f. power.

621.317.784 **1743**

Audio-Frequency Power Measurements by Dynamometer Wattmeters.—A. H. M. Arnold. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 192–199. Discussion, pp. 199–203.) The screening necessary to obtain accuracy in the upper a.f. range comparable to that at power frequencies is discussed. An account is given of methods used at the N.P.L. to calibrate wattmeters. The useful upper frequency limit is taken as the frequency at which a significant deflection is obtained with voltage only or current only applied to the terminals.

621.317.784 : 538.632 : 537.311.33 **1744**

The Design of Semiconductor Wattmeters for Power-Frequency and Audio-Frequency Applications.—H. E. M. Barlow. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 186–191, Discussion, pp. 199–203.) Design details and performance characteristics are given for two wattmeters based on the Hall effect in semiconductors (1735 above), for use at frequencies up to 150 c/s and 20 kc/s respectively. The power-frequency instrument incorporates an iron-cored magnetizing coil; the a.f. instrument uses air-cored coils and includes screening arrangements. These instruments offer advantages over other types for measurements of high power.

621.37.029.6.049.001.4 **1745**

A Surface-Texture Comparator for Microwave Structures.—A. F. Harvey. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 219–222.) The dependence of the attenuation coefficient of microwave components on the relation between surface roughness and skin depth is discussed and a description is given of a simple comparator scale covering the various classes of finish in normal use. Measurements are stated in terms of the centre-line-average figure, in microinches, obtained on traversing a small stylus over a sample of the surface. Comparisons are made by sight and by touch.

621.373.42.001.4 : 621.317.361 **1746**

Testing Precision Oscillators.—M. P. Johnson. (*Wireless World*, April 1955, Vol. 61, No. 4, pp. 179–182.) The frequency stability of 124-kc/s oscillators used as masters for carrier-frequency telephone systems is determined by comparison with the 2·5-Mc/s standard-frequency transmissions from Rugby, the measurement being made at a point 10 miles away. Counts of the difference frequency are made over regularly recurring sampling periods, and an output current proportional to the count is obtained. A linear recording meter is used; full-scale deflection is produced by a count of 58, corresponding to a frequency difference of 2 parts in 10^7 for a sampling period of 116 sec. The equipment is described and specimen records are shown.

621.373.52 : 621.314.7 **1747**

Transistorized F.M. Signal Generator.—J. J. Hupert & T. Szubski. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 133–135.) An instrument covering the frequency range 20–100 Mc/s has been designed giving an output of 10 mW across 10 Ω. The v.h.f. section comprises a f.m. oscillator operating at a half or a third of the output frequency, followed by a harmonic-selector stage. The frequency modulation is effected by a transistor acting as variable reactance. The relative merits of point-contact and junction-tetrode transistors for this circuit are discussed. The saving in bulk as compared with equipment using thermionic valves is to some extent offset by the need for a constant-temperature enclosure for the oscillator.

621.375.2.024.083 : 681.142 **1748**

Gain Measurements on Computing Amplifiers.—A. B. Johnson. (*Electronic Engng*, March 1955, Vol. 27, No. 325, pp. 127–129.) Special techniques are required for measurements on amplifiers for d.c. analogue computers, which usually have very high gain. Methods are divided into two broad classes, (*a*) direct, in which the drift output is reduced without affecting the test signal, the amplifier operating effectively without feedback for the latter, and (*b*) indirect, in which the drift output is small because of negative feedback, and the gain is deduced from some other property.

621.397.5 : 535.623].001.4 **1749**

Phase Measurement for Color TV and F.M.—K. Schlesinger. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 142–146.) The principles of operation with the vectorscope are described.

621.317.3.029.6 **1750**

Handbook of Microwave Measurements, Vols. 1 & 2. [Book Review]—M. Wind & H. Rapaport, Eds. Publishers: Polytechnic Institute of Brooklyn, New York, 616 pp. and 320 pp. (*Wireless Engr*, April 1955, Vol. 32, No. 4, p. 116.) A useful compendium not only for the technician but also, as a supplement to more theoretical treatments, for the engineer or physicist. The text is all in Volume 1, the diagrams are in Volume 2.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.3 : 61 **1751**

Electricity in Medicine.—S. N. Pocock. (*Proc. Instn elect. Engrs*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 629–638.) A survey of applications of electronic techniques in diagnosis and therapy.

621.317.39 : 531.71 **1752**

A Direct-Reading Instrument for the Measurement of Small Displacements.—W. D. Corner & G. H. Hunt. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, pp. 445–447.) Displacements down to 2×10^{-7} cm were measured with an accuracy of within 10^{-7} cm by means of a bridge circuit using a differential capacitor, with a 100-V, 10-kc/s supply. The unbalance was measured by a direct-indicating valve voltmeter. The apparatus was designed for magnetostriction measurements.

621.384.612 **1753**

Generating R.F. Energy for 6-kMeV Bevatron.—C. N. Winningstad. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 164–169.)

621.385.833 **1754**

Extension of the Electron-Optical Theory of the Deflecting Electrostatic System to the Case of Relativistic Particles.—A. M. Strashkevich. (*Zh. tekh. Fiz.*, Dec. 1954, Vol. 24, No. 12, pp. 2264–2270.)

621.385.833 **1755**

Aberrations of Relativistic Electron Beams.—A. M. Strashkevich & N. G. Gluzman. (*Zh. tekh. Fiz.*, Dec. 1954, Vol. 24, No. 12, pp. 2271–2284.) A mathematical discussion is presented of the operation of a system with a curved axis. Equations (9) and (10) are derived for a wide beam in an arbitrary electrostatic field for the relativistic case. Equations are also derived for the particular cases of a wide beam in an axially symmetric field (28) and in a plane field (30) as well as in the fields of a cylindrical lens (33) and a cylindrical condenser (35). The aberrations of axially symmetric lenses are calculated for the relativistic case (40)–(45), and also of cylindrical lenses (50)–(53).

621.385.833 **1756**

Simple Presentation of the General Theory of Systems of Revolution in Electron Optics (covering Relativity and Aberrations).—É. Durand. (*Rev. d'Optique*, Dec. 1954, Vol. 33, No. 12, pp. 617–629.) Calculations are simplified by introducing complex combinations into the Lagrangian.

621.387.424 : 537.52 **1757**

A Cloud-Chamber Study of some Aspects of the Geiger Discharge.—P. J. Campion. (*Proc. phys. Soc.*, 1st Dec. 1954, Vol. 67, No. 420A, pp. 1095–1102.)

621.396 : 623.451.8 **1758**

Launching Control for Guided Missiles.—J. B. Schrock. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 122–127.) A description of the circuits which control the firing of the missile, actuate the guiding and telemetering equipment, and alert rocket-range control units.

PROPAGATION OF WAVES

538.566 **1759**

Coupled Wave Equations for Inhomogeneous Anisotropic Media.—K. Suchy. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 630–636.) "A special system of coordinates has been introduced for the calculation of electromagnetic wave propagation in an inhomogeneous, anisotropic medium. One of the coordinate axes is parallel to the wave normal, the two others (perpendicular to it) are defined by the relation between the **E** and $\tilde{\mathbf{D}}$ vector. In the coupled wave equations it is shown that the coupling terms can be neglected under certain conditions."

538.566 **1760**

On the Possibility of Electromagnetic Surface Waves.—P. S. Epstein. (*Proc. nat. Acad. Sci., Wash.*, Dec. 1954, Vol. 40, No. 12, pp. 1158–1165.) An independent surface wave is defined as comprising two inhomogeneous waves which are independent of each other and run along the surface dividing two media, one wave in either medium. A discussion of the conditions for the existence of such a wave indicates that it could exist only at the boundary of two nonconducting media, one with a positive dielectric constant, the other with a negative one. Sommerfeld's solution for the field of an electric dipole at the surface of a plane earth is briefly commented on.

538.566 : 537.56 **1761**

General Expression for the Absorption of Electromagnetic Waves in Lorentz-Type Plasmas (Ionosphere).—M. Lozzi, R. Jancel & T. Kahan. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 162–164.) A general expression is derived from the theory presented previously [2364 of 1954 (Jancel & Kahan)].

538.566.2 **1762**

Reflection and Refraction of Electromagnetic Waves in a Stratified Medium.—K. Försterling. (*Hochfrequenztech. u. Elektroakust.*, April 1954, Vol. 63, No. 4, pp. 112–116.) Exact analysis is presented and the effect of certain approximations is discussed. Splitting due to the presence of magnetic fields is considered.

621.396.11 **1763**

Theory of Radio Transmission by Tropospheric Scattering using Very Narrow Beams.—H. G. Booker & J. T. deBettencourt. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 281–290.) When propagation is effected by scattering from turbulences in the troposphere [1757 of 1950 (Booker & Gordon)], the energy arriving at the receiver may be expected to extend over a substantial angle; it should be possible to demonstrate the effect by using narrow beams, of width less than about 1·5°. Calculations are made for a communication path of length 300 km between paraboloidal aerials of diameter 100λ; a beam width of 0·73° is assumed. A study is made of the effects to be expected on swinging the two beams in synchronism so that their axes always intersect; a lateral swing of 1° off the great-circle path would reduce the received power by about 7 db if propagation is controlled by scattering, whereas it would reduce the received power by about 40 db if propagation is controlled by refraction. The distortion of pulses to be expected as a result of beam swinging is evaluated. Choice of communication bandwidths is discussed.

621.396.11 : 551.510.535 **1764**

Measurement of Attenuation in the Ionosphere.—A. Ochs. (*Arch. elekt. Übertragung*, Dec. 1954, Vol. 8, No. 12, pp. 535–544.) A fixed-frequency method based on a continuous photographic record of echo amplitude is discussed, and measurements made during the period October 1952–January 1953 are reported. Difficulties are introduced by ground reflection, ground irregularity, fluctuations of transmitted power, the effect of the extraordinary component, and nonuniformity of the ionosphere. The last-mentioned factor is especially important, and its effects are illustrated by field-strength records of a signal (*a*) once reflected and (*b*) twice reflected from the E layer. The absence of correlation between these records can be explained by assuming that the reflected surface is inclined or curved, and/or that within the usual ionosphere strata there are local regions, or clouds, with higher concentrations of electrons. To eliminate errors due to the focusing effect of the curved surface, measurements must be averaged over a suitable period, must be made at suitably spaced points, and must be made simultaneously at different frequencies. If only a single frequency is used, this should be as low as possible with the available power. Details are given of the equipment used. Carrier frequencies of 2 Mc/s and, later, 1·6 Mc/s were used, with pulse duration 100 μs, pulse power 15–20 kW, and pulse repetition rate 50 or 1 per sec. The results indicate considerable interdiurnal differences of the diurnal variation of attenuation.

621.396.11 : 551.510.535 **1765**

Ionospheric Absorption Measurements at Prince Rupert.—K. Davies & E. L. Hagg. (*J. atmos. terr. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 18–32.) Report and discussion of measurements made near the northern auroral zone between April 1949 and March 1950. Monthly median noon values of total absorption, $-\log \rho$, do not fit the inverse square law $-\log \rho \propto (f + f_L)^{-2}$; seasonal variation indicates little dependence on solar zenith angle χ. Diurnal variation is very approximately represented by the relation $-\log \rho \propto (\cos \chi)^{0\cdot5}$, maximum absorption generally occurring about 20 minutes after local noon. There is a pronounced correlation between night-time absorption at 2 Mc/s and the 3-hour-range K index for $K > 4$. High night-time absorption is often associated with intense sporadic E.

621.396.11 : 551.510.535 **1766**

Influence of the Inclination of the Earth's Magnetic Field on the Absorption of Radio Waves in the D Layer.—P. Lejay & D. Lepechinsky. (*C. R. Acad. Sci., Paris*, 10th Jan. 1955, Vol. 240, No. 2, pp. 136–138.) Analysis is presented and its application is illustrated by evaluating the absorption index for three particular directions of propagation. For the extraordinary ray the absorption increases considerably with increase of the angle between the direction of the earth's magnetic field and the direction of propagation; for the ordinary ray the variation of absorption is in the opposite sense. The results indicate that caution is necessary in applying absorption values obtained from vertical soundings to conditions along actual radio communication paths; the cosine law is not directly applicable.

621.396.11 : 551.510.535 **1767**

Reflection Conditions for Vertical Propagation in the Ionosphere in the Presence of Collisions and of the Earth's Magnetic Field. Case of the E Layer.—D. Lepechinsky & J. Durand. (*C. R. Acad. Sci., Paris*, 17th Jan. 1955, Vol. 240, No. 3, pp. 333–336.) The type of propagation, i.e. quasi-transverse or quasi-longitudinal, occurring in a given region of the ionosphere is determined by θ, the inclination of the earth's magnetic field, and the collision number. A graph shows the height h at which the transition occurs, as a function of θ; h coincides with the E layer (100 km) for a value of θ about 65°, i.e. in France at about the latitude of Paris; propagation there is quasi-transverse or quasi-longitudinal according as the collision number increases or decreases. Consideration of the relation between refractive index and electron concentration for the two types of propagation indicates that neglect of collisions introduces error in the calculated values of f_0E for values of $\theta > 65°$. These considerations are shown to explain the apparent flattening of the daily variation curve of f_0E around midday.

621.396.11.029.55 **1768**

The Prediction of Short-Wave Propagation.—B. Beckmann. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 9/10 & 11/12, pp. 211–219 & 247–259.) Concepts fundamental to ionospheric and radio weather (3665 of 1954) and the relations between them are discussed. The relevance of solar, geomagnetic and ionospheric factors in forecasting is indicated. An examination is made of the accuracy of forecasts and of the causes of error, e.g. scattering. Statistics are presented showing differences in reception of WWV transmissions at Norddeich and Munich.

621.396.11.029.6 **1769**

An Experimental Study of the Propagation of 10 cm Radio Waves over a Short Non-optical Sea Path.—E. F. Stack-Forsyth. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 231–236.) Tests over a path 1·14 times the optical-horizon distance were made off the coast of Natal during the winter months April–August 1953. Vertical polarization was used. The effect on signal strength of variations in the structure of the refractive-index profile of the atmosphere in the first few hundred feet above sea level was studied. The results indicate that a duct about 120 ft high was present for a considerable part of the winter. The signal strength at a height of 47 ft in the duct was 6–10 db above the free-space value. The absolute value of the signal strength and its variation with duct height are in moderately good agreement with values given by the mode theory, using only the first mode and assuming either a square-law, fifth-root or bilinear profile.

621.396.11.029.6 : 551.510.535 **1770**

Study of Long-Distance Propagation of V.H.F. Waves by Sporadic-E Ionization.—T. Kono, Y. Uesugi, M. Hirai & G. Abe. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 1–10.) A report is presented of vertical-incidence measurements and propagation tests carried out in Japan between June and August 1952, over distances of 500–1 100 km at frequencies of about 31, 43, and 65 Mc/s. Results were analysed statistically; empirical expressions are given for the relation between $fE_s/f \cos i$ and F, where F is the field strength relative to the free-space field strength, f is the transmission frequency, and i is the angle of incidence. The probability of the calculated value of F exceeding its actual value can be estimated. Results are presented graphically.

621.396.11.029.6 : [551.524 + 551.57 **1771**

What Role does the Nocturnal Cooling play in the Ultra-short-Wave Propagation?—K. Hirao. (*J. Radio Res. Labs, Japan*, March 1954, Vol. 1, No. 1, pp. 27–39.) Variations of the temperature and humidity in the lower atmosphere at the transmitter are compared with the field-strength variations at the receiving station. The frequency used was 150 Mc/s. Results are tabulated and also presented graphically. Nocturnal cooling has both a direct effect and an indirect effect through the resulting changes of humidity.

621.396.812.3 : 551.510.535 **1772**

The Autocorrelogram of Randomly Fading Waves.—R. B. Banerji. (*J. atmos. terr. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 50–56.) The received power spectrum for the case of a completely rough ionosphere having superposed steady and random motion is deduced assuming transmitting and receiving aerials omnidirectional. Autocorrelograms of fading patterns corresponding to pure drift and pure turbulence are compared. An observed fading pattern need not contain more than 250 independent points for these two extreme cases to be distinguished. See also 2120 of 1953.

RECEPTION

621.396.621 **1773**

Logarithmic-Amplifier Simplifications and Improvements.—D. E. Sunstein : T. H. Chambers. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 343–344.) Comment on 3345 of 1954 (Chambers & Page) and reply.

621.396.621 **1774**

Statistical Survey of the Engineering Construction of Broadcast Receivers [in Western Germany].—W. W. Diefenbach. (*Funk-Technik, Berlin*, Dec. 1954, Vol. 9, No. 24, pp. 674–676.)

621.396.621 : 621.376.3 **1775**

Reception of Frequency-Modulated Oscillations with Automatic Matching of Receiver Bandwidth to the Dynamic Range of the Modulation.—K. Lamberts. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 665–669.) For weak signals in wide-band noise, the a.f. signal/noise ratio of a f.m. receiver can be improved by restricting the i.f. bandwidth. A circuit is described for varying this bandwidth automatically in proportion to the variations of the frequency deviation. An improvement of 14 db is obtained by a 1 : 4 reduction of bandwidth. The system does not eliminate impulsive noise.

621.396.621.54 : 621.314.7 **1776**

Transistor Broadcast Receivers.—A. P. Stern & J. A. Raper. (*Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, pp. 1107–1112.) General design principles are discussed and circuit diagrams are shown of some experimental a.m. superheterodyne receivers using point-contact and junction transistors. Good quality reception is attainable.

621.396.82 : 621.376.3 **1777**

Reception of an F.M. Signal in the Presence of a Stronger Signal in the Same Frequency Band, and other Associated Results.—R. M. Wilmotte. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 260–261.) Discussion on 1899 of 1954.

621.396.828 **1778**

Interference Suppression.—R. Davidson. (*Wireless World*, April 1955, Vol. 61, No. 4, pp. 173–176.) Techniques for dealing with small commutator motors are described. Details are given of recently developed lead-through capacitors.

STATIONS AND COMMUNICATION SYSTEMS

621.376.2 **1779**

Tables of Bennett Functions for the Two-Frequency Modulation Product Problem for the Half-Wave Linear Rectifier.—R. L. Sternberg, J. S. Shipman & W. B. Thurston. (*Quart. J. Mech. appl. Math.*, Dec. 1954, Vol. 7, Part 4, pp. 505–511.) For previous work see 3028 of 1954 (Sternberg) and 2212 of 1954 (Sternberg & Kaufman).

621.376.5 : 621.39 **1780**

Average Spectrum of a Periodic Series of Identical Pulses Randomly Displaced and Distorted.—R. M. Fortet. (*Elect. Commun.*, Dec. 1954, Vol. 31, No. 4, pp. 283–287.) See 544 of February.

621.376.56 : 621.39 **1781**

Signal/Noise Ratio in Pulse Code Modulation.—N. L. Yates-Fish & E. Fitch. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 204–210.) Formulae are derived for the output signal/noise ratio in simple pulse-code modulation systems for all values of input signal/noise ratios. The output ratio improves very rapidly with increasing input ratio provided the latter exceeds a certain critical value. The system is useful for links connected in tandem, since degradation of the overall performance below that for a single link may be avoided by a relatively small increase of power in each link.

621.376.56 : 621.39 **1782**

Study of Pulse-Code Modulation.—C. Villars. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1954, Vol. 32, No. 12, pp. 449–472. In French.) An account is given of an experimental installation developed in collaboration with C. Margna. A binary counter is used as coder, and 32 discrete amplitude levels are recognized on each side of zero. Two types of receiver were constructed, one in which each pulse is treated separately and the other in which pulses are treated in groups, as described by Meacham & Peterson (2366 of 1948). Measurements of signal quality and of the improvement of signal/noise ratio between the h.f. and a.f. channels are reported and compared with international standard requirements; the a.f. bandwidth is quite satisfactory but quantization noise may be excessive. For multichannel communications the system compares well with others in respect of reliability, freedom from crosstalk, and ease of providing secrecy.

621.391.1 **1783**

Prospects for the Development of Transmission Paths.—E. Hölzler. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 647–651.) Review and comparison of various types of line and radio paths. Manufacturing difficulties appear to limit the bandwidth of tubular lines to about 10 Mc/s. The possibilities of surface-wave lines at u.s.w. are discussed. Special types of dielectric and metal waveguides may prove suitable at frequencies above that (10–15 kMc/s) for which atmospheric absorption on radio paths becomes excessive.

621.395.44 : 621.315.28 **1784**

A Transatlantic Telephone Cable.—Kelly, Radley, Gilman & Halsey. (See 1547.)

621.396.41 : 621.376.3 **1785**

Linearity Requirements for Multichannel F.M. Radio-Link Systems.—G. Bosse. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 678–682.) The relations between the measured distortion factor and the noise in frequency-division multichannel systems are calculated by substituting an equivalent noise voltage for the sum of the voltages in the channels. Nonlinear distortion due to curvature of modulator and demodulator characteristics and to transmission-time variations is considered. Diagrams are presented from which a determination can be made of the maximum permissible distortion factor for a given signal/noise ratio, and of the optimum amount of pre-emphasis.

621.396.41 : 621.376.3 **1786**

Problems of Frequency Modulation in Multichannel Radio Links.—H. Meinke. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 670–677.) The four principal criteria to be considered in deciding on the type of modulation to use in a multichannel system are (*a*) signal/noise ratio, (*b*) crosstalk, (*c*) bandwidth requirements, (*d*) equipment requirements. An account is given of experimental work on systems using individual-channel f.m. Comparison is made with p.ph.m. systems. The results with the f.m. system are promising.

621.396.41 : 621.396.65 **1787**

Wide-Band Radio Links: Deliberations of Study Commission No. 9 of the C.C.I.R. at Geneva (from 10th to 22nd September 1954).—W. Klein. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1954, Vol. 32, No. 12, pp. 497–499. In French.) Proposals for standardizing multichannel links are reported; both frequency-division f.m. systems and time-division p.p.m. systems are considered.

621.396.41.029.62 : 621.396.822.1 **1788**

Intermodulation Noise in V.H.F. Multichannel Telephone Systems.—J. L. Slow. (*J. Brit. Instn Radio Engrs*, Feb. 1955, Vol. 15, No. 2, pp. 67–83.) Intermodulation noise due to various forms of distortion in the radio circuits of a frequency-division multiplex system is analysed. Expressions are derived of the form $\overline{N}_n = \overline{H}_n + n\overline{P} + C$, where $\overline{N}_n$ is the nth-order noise power and $\overline{P}$ the multichannel speech power in db referred to 1 mW, $\overline{H}_n$ is the nth-harmonic ratio of a test tone in db and C is a constant. The analysis is valid for f.m. systems handling up to 60 channels. Formulae and curves are given and single-tone and two-tone tests are described for determining the intermodulation noise due to (*a*) modulator/demodulator distortion, (*b*) phase distortion, (*c*) feeder mismatch.

621.396.66 : 621.396.61 **1789**

Operational Measurements on U.S.W. [f.m.] **Broadcast Transmitters.**—L. Merkl. (*Arch. tech. Messen*, Dec. 1954, No. 227, pp. 269–272, & Jan. 1955, No. 228, pp. 7–10.) Measurements considered include the monitoring of voltages and valve currents, r.f. output power, frequency and distortion.

621.396.665.1 : 621.396.65 : 621.376.3 **1790**

Transmission of Speech with Dynamic Compression.—G. Hässler. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 659–664.) The method of operation of the syllable compandor is described. Design advantages resulting from use of these compandors in multichannel carrier-frequency systems are indicated. The example of a f.m. radio link is treated numerically.

621.396.712.029.62 + 621.396.61 **1791**

Some Aspects of V.H.F. Sound Broadcasting and F.M. Broadcast Stations.—P. A. T. Bevan. (*Electronic Engng*, March & April 1955, Vol. 27, Nos. 325 & 326, pp. 96–101 & 147–153.) The relative merits of systems using a.m., a.m. with limiting, and f.m. are discussed, mainly on the basis of their effectiveness for suppressing various types of noise and interference; field tests indicated the superiority of f.m. A detailed account is given of the Wrotham high-power experiment. The design of f.m. transmitters is considered, with particular reference to modulators and monitoring. The aerial and transmission-line systems, parallel operation of f.m. transmitters, and unattended operation of transmitters are also discussed.

SUBSIDIARY APPARATUS

621-526 **1792**

Closed Expansion of the Convolution Integral (A Generalization of Servomechanism Error Coefficients).—E. Arthurs & L. H. Martin. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 58–60.)

621.311.6 : 681.142 **1793**

Precision High-Current Computer Power Supplies.—A. B. Rosenstein. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, Sept. 1954, pp. 405–409. Digest, *Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, p. 1080.) A unit supplying 225 V d.c. at 15 A uses a magnetic-amplifier-regulated Se rectifier.

621.319.339 **1794**

A Portable Van de Graaff Generator.—T. R. Foord. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, pp. 440–441.) The generator described develops a maximum open-circuit voltage of about 200 kV and has a short-circuit current of 15 μA.

621.396.63 : 621.314.7 **1795**

Practical Local Calling Circuit.—(*Short Wave Mag.*, Dec. 1954, Vol. 12, No. 10, pp. 556–558.) The circuit diagram of an experimental local-station calling device designed for operation on the 160-m amateur band is given and discussed. The unit is basically a transistor receiver which operates a calling bell via a relay. Power consumption is of the order of 0·5 kWh per annum.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5(44) **1796**

The French Television Network.—(*Télévision*, Dec. 1954, No. 49, pp. 305–307.) Details are given of revised frequencies for channels 1–12, and basic operational data for the various stations are tabulated.

621.397.5 : 535.623].001.4 **1797**

Phase Measurement for Color TV and F.M.—K. Schlesinger. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 142–146.) The principles of operation with the vectorscope are described.

621.397.61 : 621.372.54 **1798**

Filters for Television Transmitter Diplexers.—G. Meyer-Brötz. (*Fernmeldetech. Z.*, Dec. 1954, Vol. 7, No. 12, pp. 683–688.) The requirements for separating filters used with combined sound and vision aerial systems differ from those for other diplexers because the bandwidth of the vision signal is large compared with the frequency separation of the two carriers. Various types of diplexer are surveyed, and the design of notch diplexers composed of coaxial lines is discussed particularly.

621.397.611 : 535.623 **1799**

Chromacoder Colorcasting.—C. G. Lloyd & P. H. Boucheron. (*Radio-Electronic Engng*, Dec. 1954, Vol. 23, No. 6, pp. 7–9..35.) A description is given of a system employing emitron storage tubes for conversion of the sequential colour signal, obtained from a monochrome television camera with a rotating colour-segment disk in the lens system, into a N.T.S.C.-standard signal. See also 275 of January.

621.397.7 + 621.397.26 **1800**

The Television Transmitter and Relay Installations at Antwerp.—(*Radio Rev. TV*, Dec. 1954, Vol. 6, No. 12, pp. 610–613.) The station, installed at the top of the 23-storey Torengebouw, operates as a two-way microwave link between Brussels and Breda, at the same time broadcasting the received programme in band I at a mean power of 2·5 kW. Sound is transmitted by cable. An outline description of the broadcast transmitter is given.

621.397.7 : 778.5 **1801**

Considerations on the Operation of Vidigraphs.—Y. Angel. (*Onde élect.*, Dec. 1954, Vol. 34, No. 333, pp. 958–973.) The term 'vidigraph' is proposed for apparatus for the cinematographic recording of television programmes from the face of a receiver tube. A particular system is described using a long-persistence screen. Problems of obtaining correct contrast are discussed.

621.397.7 : 778.5 : 621.395.625.3 **1802**

The 16-mm Substandard Film with Magnetic Stripe [for sound] **as used in the Südwestfunk Television Service—Equipment and Operating Methods.**—H. Lauer & O. Schulze. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 9/10, pp. 203–210.)

621.397.7.029.62 : 621.372.51 **1803**

V.H.F. Power Transmission Equipment for Band III Television Broadcast.—B. M. Sosin. (*Marconi Rev.*, 3rd Quarter 1954, Vol. 17, No. 114, pp. 88–100.) A descriptive account including some technical details on the construction and the characteristics of a system for linking television sound and vision transmitters to a common aerial. The system includes a vestigial-sideband filter, a frequency-discriminating combining filter, test load and feeder monitoring components.

621.397.8 **1804**

Various Factors affecting Picture Quality in Television. Possibilities of Improvement.—F. Below. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 9/10, pp. 195–202.) Deleterious effects due to bandwidth limitation and overshoot are considered. Methods of reducing defects due to the vestigial-sideband system of transmission are indicated. Crispening technique described by Goldmark & Hollywood (828 of 1952) and spectrum equalization methods described by Gouriet (1936 of 1953) are discussed. Improvements can be effected by reshaping or replacing the synchronizing pulses and by correct adjustment of level and gamma.

621.397.81 : 621.397.26 **1805**

Propagation on Bands I and III.—F. W. R. Strafford & I. A. Davidson. (*Wireless World*, April 1955, Vol. 61, No. 4, pp. 171–172.) A direct comparison has been made of propagation in the two bands by radiating 180·4-Mc/s signals from the B.B.C. mast at Sutton Coldfield, as well as the television waveform on 61·75 Mc/s. Two receivers were installed in a mobile unit, and continuous records of signal strength were made. The receiving aerials were at a mean height of 25 ft, thus the difference between the local variations at the two frequencies could be investigated. Rapid variations due to reflecting objects and slow variations possibly due to ground irregularities were observed. The significance of the latter for calculations of service area is discussed. The mean level of the band-III signal decreases with increasing distance faster than that of the band-I signal, as predicted theoretically.

TRANSMISSION

621.396.61 : 621.314.7 : 621.311.6 : 621.383.5 **1806**

SPTTX [sun-powered transistor transmitter] **Demonstration for N.P.L.**—(*Short Wave Mag.*, Dec. 1954, Vol. 12, No. 10, p. 557.) Brief note on a demonstration of the transmitter referred to in 1167 of April.

621.396.61 : 621.372.2 **1807**

Frequency Stability of Self-Excited Transmitters with Long Aerial Feeders.—A. Käch. (*Arch. elekt. Übertragung*, Nov. & Dec. 1954, Vol. 8, Nos. 11 & 12, pp. 491–498 & 553–561.) A stability criterion is derived whereby the influence of the transmitter is reduced to that of a single equipment constant which can be determined experimentally. The magnitude of this constant and the data of the feeder line uniquely determine the load conditions at the stability limit. For a given type of line the retroaction of the load on the transmitter is greatest for a line length giving a total attenuation of about 3 db. The corresponding critical mismatch at the line termination is shown in normalized load curves. Experimental methods are described for determining the transmitter constant, and an indication is given of the maximum frequency shift to be expected. Agreement between theoretical and practical results is good.

621.396.61 : 621.576 **1808**

Phase-to-Amplitude Modulation.—B. D. Virmani. (*Wireless World*, April 1955, Vol. 61, No. 4, pp. 183–187.) High efficiency can be obtained with phase-to-amplitude modulation because (*a*) the phase modulation is performed at low level, and (*b*) the valves in the two ph.m. r.f. channels can be continuously driven to their limits. Details are given of a 400-W transmitter covering the frequency bands 3·5–8, 13–30 and 26–56 Mc/s and permitting either phase-to-amplitude-modulation or s.s.b. operation; the conventional oscillator and phase-shifting network are replaced by a polyphase oscillator, which retains the correct phase displacement when the oscillator frequency is varied.

621.396.61 : 621.396.712.029.62 **1809**

Some Aspects of V.H.F. Sound Broadcasting and F.M. Broadcasting Stations.—Bevan. (See 1791.)

VALVES AND THERMIONICS

621.314.63 + 621.314.7 **1810**

Saturation Current in Alloy Junctions.—W. M. Webster. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 277–280.) Theory is developed for diodes made by alloying circular junctions on to thin base wafers. An equation is derived from which the value of I_s, the saturation current obtained with reverse biasing, can be calculated. Most of this current originates from thermal generation at the free surfaces of the base. I_s increases linearly with base resistivity and exponentially with temperature; it also increases, but more slowly, with base thickness and surface recombination velocity. The equation for the collector of an alloy-junction transistor is basically the same as for a diode, with a correction for the emitter. For the emitter junction the equation requires modification.

621.314.63 : 546.289 **1811**

Inductive Behaviour of *p-n* Junctions in the Forward Direction.—G. Kohn & W. Nonnenmacher. (*Arch. elekt. Übertragung*, Dec. 1954, Vol. 8, No. 12, pp. 561–564.) The observed time lag of the forward conductance of Ge diodes [3282 of 1952 (Einsele)] cannot be explained in terms of the usual equivalent circuit comprising parallel voltage-dependent resistance and capacitance. A circuit comprising resistance in series with parallel inductance and resistance fits the observations and is also consistent with the small-signal frequency variation of the diode impedance.

621.314.63 : 546.289 **1812**

Admittance Measurements on Alloyed Germanium-Indium Rectifiers.—H. L. Rath. (*Z. Naturf.*, July/Aug. 1954, Vol. 9a, Nos. 7/8, pp. 699–700.) A method is described for determining the admittance from the characteristic variation of the capacitance with frequency at different temperatures.

621.314.632 + 621.314.7].002.2 **1813**

Transistors and Germanium Diodes.—(*Elect. Rev., Lond.*, 19th Nov. 1954, Vol. 155, No. 21, pp. 791–795.) An account of production techniques used in Britain for the manufacture of point-contact crystal valves on a comparatively large scale.

621.314.7 **1814**

Transistors and their Applications—a Bibliography, 1948–1953.—A. R. Krull. (*Trans. Inst. Radio Engrs*, Aug. 1954, Vol. ED-1, No. 3, pp. 40–77.)

621.314.7 **1815**

Electrical Characteristics of Power Transistors.—A. Nussbaum. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 315–322.) Measurements have been made on *p-n-p* junction transistors with collector dissipation of about 20 W [3391 of 1954 (Roka et al.)]. The results relating to parameters which are a function of current strength do not agree with those obtained theoretically for low-power operation [3390 of 1954 (Rittner)]. Plans for further investigations are indicated.

621.314.7 : 537.311.33 : 546.28 **1816**

Electronic Behaviour of Certain Grain Boundaries in Perfect Crystals.—Mataré. (See 1690.)

621.314.7 : 621.317.755 **1817**

An Alpha Plotter for Point-Contact Transistors.—T. P. Sylvan. (*Elect. Engng, N.Y.*, Dec. 1954, Vol. 73, No. 12, pp. 1094–1098.) Description, with detailed parts list, of a c.r.o. test set.

621.383.27 **1818**

The Transit Time of Electrons in Photomultipliers.—E. H. Rhoderick & R. W. P. McWhirter. (*J. sci. Instrum.*, Dec. 1954, Vol. 31, No. 12, p. 475.) Experimental results on commercial 11- and 13-stage photomultipliers indicate transit times ranging from about $5{\cdot}5$ to 8×10^{-8} sec at voltages between 185 and 105 V per stage.

621.383.5 **1819**

Electronic Interpretation of Inertia Phenomena in Photocells (in particular, Internal Capacitance).—G. Blet. (*J. Phys. Radium*, Dec. 1954, Vol. 15, No. 12, pp. 823–828.) See 2801 of 1954.

621.383.5 **1820**

Barrier-Layer Photocells: Part 1.—D. Geist. (*Arch. tech. Messen*, Dec. 1954, No. 227, pp. 281–284.) A brief account of the mechanism and operational characteristics of *p-n* junction and metal-semiconductor barrier-layer photocells. 35 references.

621.385.029.6 **1821**

The Traveling-Wave Tube—a Record of its Early History.—R. L. Wathen. (*J. Franklin Inst.*, Dec. 1954, Vol. 258, No. 6, pp. 429–442.)

621.385.029.6 **1822**

A Large-Signal Theory of Traveling-Wave Amplifiers.—P. K. Tien, L. R. Walker & V. M. Wolontis. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 260–277.) Analysis presented by Nordsieck (2497 of 1953) is extended to cover space-charge effects at high operating levels. In addition to the space-charge parameter QC and the other parameters used in linear theory, a parameter k is introduced such that $1/k$

is proportional to the beam radius and gives an indication of the range of action of the space-charge forces. Computations have been made for a number of typical cases; amplitude and phase of the circuit wave are given as functions of distance. The limiting efficiency increases with electron injection speed, increases first and then decreases with increase of QC, and increases with $1/k$, assuming uniform distribution of field and current over the cross-section. The electron motion is analysed.

621.385.029.6 **1823**

The Performance of Travelling-Wave Valves at High Input Levels.—W. Klein & W. Friz. (*Fernmeldetech. Z.*, July 1954, Vol. 7, No. 7, pp. 349–357.) The helix is considered as a succession of elementary zones, in each of which linear amplification theory is applicable, and the power output is determined in successive steps. Losses are taken into account, and graphs show the dependence of other parameters on the velocity and loss parameters. The effect of an attenuating section on amplification and the optimum choice of its position are examined. The expressions developed are interpreted with reference to a particular valve and the output-power/input-power curve discussed in detail. The importance of the coupling factor C in predicting valve performance is stressed. Amplification at low and high input levels is compared, and the effects of operating voltage and type of helix considered. An estimate is made of the greatest power output compatible with linear operation. Computed and measured values are in reasonable agreement in all cases.

621.385.029.6 **1824**

Traveling-Wave-Tube Characteristics for Finite Values of C.—C. K. Birdsall & G. R. Brewer. (*Trans. Inst. Radio Engrs*, Aug. 1954, Vol. ED-1, No. 3, pp. 1–11.) Values of the performance parameters of travelling-wave valves are presented in the form of curves for values of the gain parameter C up to 0·5 and for relatively large values, up to 2, of the space charge parameter QC.

621.385.029.6 **1825**

Cross-Wound Twin Helices for Traveling-Wave Tubes.—M. Chodorow & E. L. Chu. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 33–43.) When a single-helix structure is used with voltages above about 10 kV, a large proportion of the energy is diverted into noninteracting space harmonics, with a corresponding reduction of the impedance for the fundamental interacting mode; undesired backward waves may also be generated. Use of a twin helix eliminates these drawbacks. For a particular twin helix with radius $0{\cdot}4\ \lambda/2\pi$, the impedance for the fundamental mode was more than twice that of a single helix of the same radius. Dispersion is greater with the twin helix.

621.385.029.6 **1826**

Electronic Resonance Effect in Valves with Crossed Electric and Magnetic Fields.—W. Willshaw, G. Mourier & G. Guilbaud. (*C. R. Acad. Sci., Paris*, 17th Jan. 1955, Vol. 240, No. 3, pp. 283–285.) A formula is presented expressing the conditions under which electronic resonance is liable to disturb the normal operation of travelling-wave valves using lines with periodic structure. A large effect is produced when the resonance corresponds to a space harmonic with high-intensity field. Measurements of the variation of efficiency of a carcinotron over the electronic tuning range are discussed in the light of the theory.

621.385.029.6 **1827**

Excitation of the Carcinotron M Valve.—G. Mourier. (*C. R. Acad. Sci., Paris*, 24th Jan. 1955, Vol. 240, No. 4, pp. 406–408.) An investigation is made of the current build-up in backward-wave oscillator valves of the type discussed by Guénard et al. (3616 of 1952); the calculations are based on the energy exchanges between beam and delay line. A coefficient Q_a is introduced defining the excitation quality; an expression is given for Q_a depending on delay-line length, operating wavelength, electron and wave velocities, and ratio of instantaneous current to current in the oscillating state. The excitation time varies in the same sense as Q_a.

621.385.029.6 **1828**

Influence of Space Charge on the Excitation Current of a Carcinotron-Type Magnetron Oscillator.—B. Epsztein. (*C. R. Acad. Sci., Paris*, 24th Jan. 1955, Vol. 240, No. 4, pp. 408–410.) Values found experimentally for the excitation current in the carcinotron M valve are generally lower than values derived from the formula of Guénard et al. (3616 of 1952) and Warnecke et al. (3085 of 1954). A new formula is developed taking account of space charge effects; satisfactory agreement is then obtained between the theoretical and experimental values.

621.385.029.6 **1829**

Resonant Behavior of Electron Beams in Periodically Focused Tubes for Transverse Signal Fields.—R. Adler, O. M. Kromhout & P. A. Clavier. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 339–341.) Transverse-field travelling-wave valves are discussed in which a ribbon beam is passed between pairs of plates at alternate high and low potentials; resonance is observed over a range of focusing conditions. A formula is derived for the resonance frequency, which is equal to the plasma frequency.

621.385.029.6 **1830**

Magnetic Focusing of Electron Beams.—J. T. Mendel. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 327–331.) Analysis is developed applicable to various types of focusing used for pencil beams as in travelling-wave valves. The semi-shielded cathode offers practical advantages, in conjunction with either uniform or periodic focusing fields. Expressions are derived for the electron trajectories. Balance conditions yielding minimum beam ripple are determined; these require a high percentage of flux threading the cathode for a relatively small increase in magnetic field above the Brillouin value.

621.385.029.6 **1831**

Hysteresis in Klystron Oscillators.—T. Moreno & R. L. Jepsen. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, p. 344.) A possible explanation of electronic hysteresis is advanced based on an electronic-admittance/r.f.-voltage characteristic which is not monotonic.

621.385.029.6 : 621.372.413 **1832**

Stabilization of Reflex Klystrons by High-Q External Cavities.—S. J. Rabinowitz. (*Trans. Inst. Radio Engrs*, Sept. 1954, Vol. MTT-2, No. 3, pp. 23–26.) The effective Q of the klystron oscillator is raised by associating a high-Q external cavity with it. A suitable design of stabilization cavity and coupling network is illustrated, and experimentally determined characteristics of some stabilized klystrons are presented.

621.385.029.6 : 621.396.822 **1833**

Noise in Transverse-Field Traveling-Wave Tubes.—G. Wade, K. Amo & D. A. Watkins. (*J. appl. Phys.*, Dec. 1954, Vol. 25, No. 12, pp. 1514–1520.) Analysis indicates that in a transverse-field travelling-wave valve the noise can only be kept low if the beam is well collimated. In a particular valve for operation at 1 kMc/s, with a collimator of width 0·004 in., the theoretical noise figure is 2 db; without the collimator the noise figure would be 11 db.

621.385.029.63/.64 : 621.372.2 **1834**

Theoretical Study of Traveling-Wave Tube.—K. Udagawa. (*Rep. elect. Commun. Lab., Japan*, Aug. 1954, Vol. 2, No. 8, pp. 34–52.) Expressions are derived for the propagation constants of a coaxial arrangement of (*a*) two helices, and (*b*) a helix and dielectric cylinder. Series of curves are plotted showing the influence of the thickness of the dielectric cylinder on the phase velocity, and the characteristic impedance and attenuation of a travelling-wave-valve helix with a dielectric support. Gain is calculated taking account of thermal effects; space-charge effects and transverse electron motion are investigated.

621.385.029.63/.64 : 621.396.822 **1835**

Influencing Space-Charge Waves of Fluctuating Beams by Resonator Circuits.—K. Pöschl. (*Frequenz*, Sept. 1954, Vol. 8, No. 9, pp. 284–288.) Theoretical considerations show that the noise factor in a two-stage klystron can be reduced below the minimum given by Robinson (1618 of 1954) by using an additional resonator ahead of the input stage.

621.385.029.65 **1836**

An Experimental Broad-Band Helix Traveling-Wave Amplifier for Millimeter Wavelengths.—S. D. Robertson. (*Trans. Inst. Radio Engrs*, Sept. 1954, Vol. MTT-2, No. 3, pp. 48–54.) A valve with a helix of diameter 0·015 in. has given 19 db gain at 6 mm λ and 9 db at 5·2 mm. Design problems are discussed. An anode potential of 1 kV and a beam current of 10 mA are used.

621.385.029.65 : 621.317.361 **1837**

Cold Measurements of 8 mm Magnetron Frequency and Pulling Figure.—A. E. Barrington. (*Proc. Instn elect. Engrs*, Part B, March 1955, Vol. 102, No. 2, pp. 247–248.) A square-wave signal is applied to the magnetron, and voltages proportional respectively to the input and reflected signals are applied to the X and Y plates of a c.r.o., giving a straight-line trace whose slope is minimum at resonance. The change of resonance frequency with adjustment of the position of a puller probe is observed.

621.385.032.21 **1838**

Influence of Space Charge in Spherical Electron Guns.—N. B. Aizenberg. (*Zh. tekh. Fiz.*, Nov. 1954, Vol. 24, No. 11, pp. 2079–2082.) While it is usually assumed that the intensity of the field at the tip of the cathode in a spherical electron gun is proportional to the anode voltage, for large values of the discharge current the space charge must be taken into account. The effect of this charge is investigated experimentally and the minimum value of the discharge current for which the effect becomes noticeable is determined.

621.385.032.21 **1839**

New Forms of Thermionic Cathode.—(*Nature, Lond.*, 25th Dec. 1954, Vol. 174, No. 4443, pp. 1176–1177.) Report of a colloquium held in October 1954 and sponsored by the Institute of Physics and the Physical Society. The discussion dealt mainly with efforts to produce cathodes giving high emission over long periods.

621.385.032.21 : 537.29 **1840**

Progress in Electron Emission at High Fields.—W. P. Dyke. (*Proc. Inst. Radio Engrs*, Feb. 1955, Vol. 43, No. 2, pp. 162–167.) The properties of cold and hot field-emission cathodes yielding high current densities are surveyed and methods of stabilizing their performance are discussed.

621.385.032.216 **1841**

A New Type of Diffusion Cathode.—A. H. Beck, A. B. Cutting, A. D. Brisbane & G. King. (*Nature, Lond.*, 27th Nov. 1954, Vol. 174, No. 4439, pp. 1010–1011.) Brief details are given of a cathode made by moulding a mixture of Ni powder and (Ba, Sr) carbonate powder with a small percentage of reducing agent. The pulsed emission is shown as a function of temperature in comparison with the conventional oxide cathode and with published data for the L cathode. From determinations of the work function it is inferred that the emission originates from an incomplete monolayer of Ba ions with about 70% surface coverage. For a fuller account, see *Le Vide*, Nov. 1954, Vol. 9, No. 54, pp. 302–309.

621.385.032.216 **1842**

Contaminated-Metal Sintered Thermionic Cathodes.—R. Uzan & G. Mesnard. (*C. R. Acad. Sci., Paris*, 8th Dec. 1954, Vol. 239, No. 23, pp. 1613–1615.) New techniques are outlined for preparing high-emission moulded cathodes combining metal and oxide powders in such a way that the surface is entirely of metal. Good results are obtained with Ni when the oxide content is only just sufficient to provide the necessary diffusion to the surface; the sintering may be performed in vacuum or in a hydrogen atmosphere. W gives lower emission than Ni at low temperatures but greater emission at temperatures over 1 250°K; sintering in hydrogen lowers the emission with W. See also 3728 of 1954.

MISCELLANEOUS

621.396.6 + 621.396.712 **1843**

Development Work of [West] German Broadcasting Institutes.—H. Rindfleisch. (*Elektrotech. Z., Edn A*, 11th Sept. 1954, Vol. 75, No. 18, pp. 587–590.) A brief survey of equipment and techniques developed since the war, and particularly since 1951. 44 references.

621.396.97 **1844**

Recording and Tabulating the Radio-TV Audience.—A. C. L. Brown. (*Electronics*, Jan. 1955, Vol. 28, No. 1, pp. 126–129.) Listener research is conducted by means of film records indicating the periods during which the receiver is tuned to different channels. The recording system is applicable for other purposes, e.g., investigation of atmospheric variations.

413 = 30 = 20 **1845**

English-German Technical and Engineering Dictionary. [Book Review]—L. de Vries. Publishers: McGraw-Hill, London, 997 pp., £7. (*Wireless Engr*, March 1955, Vol. 32, No. 3, p. 90.) A companion volume to the already published German-English Dictionary. Includes many new terms in the field of radar, television, nuclear engineering, etc.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 : 551.510.52 **1846**

Sound Propagation into the Shadow Zone in a Temperature-Stratified Atmosphere above a Plane Boundary.—D. C. Pridmore-Brown & U. Ingard. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 36–42.) "The sound field in the 'shadow zone' (diffraction region) formed over a plane boundary in an atmosphere with a constant vertical temperature gradient is analyzed both theoretically and experimentally."

534.232 : 546.431.824-31 **1847**

On the Contribution of a Contained Viscous Liquid to the Acoustic Impedance of a Radially Vibrating Tube.—D. H. Robey. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 22–25.) Theoretical investigation of cylindrical $BaTiO_3$ transducers for use in fluids. Equations are derived expressing the impedance presented to the cylinder by the contained liquid and the resonance frequencies for longitudinal and coupled radial vibrations for a nonviscous liquid.

534.26 + [538.566 : 535.42 **1848**

Green's Functions for the Cylinder and the Sphere.—Franz. (See 1955.)

534.322.1 **1849**

Audibility Limits for Nonlinear Distortion in the Transmission of Instrumental Music.—G. Gässler. (*Frequenz*, Jan. 1955, Vol. 9, No. 1, pp. 15–25.) Theoretical and experimental investigations are reported, consideration being confined to instruments producing sounds with harmonically related components. The levels at which nonlinear distortion becomes audible are shown in loudness contour diagrams for various combinations of tones.

534.614-8 : 621.372.552 **1850**

Novel Uses of the Ultrasonic Light Cell.—N. B. Terry, H. Mumford & D. G. Holloway. (*A.T.E. J.*, Jan. 1955, Vol. 11, No. 1, pp. 2–16.) Experiments are described which demonstrate the use of an ultrasonic light cell as filter and as a waveform corrector of the type described by Linke (1178 of 1953). A method of measuring the wave velocity of a modulated ultrasonic wave in liquids is discussed.

534.75 **1851**

Perstimulatory Auditory Fatigue for Continuous and Interrupted Noise.—E. C. Carterette. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 103–111.)

534.75 **1852**

Perstimulatory Fatigue as Measured by Heterophonic Loudness Balances.—J. P. Egan. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 111–120.)

534.75 **1853**

Influence of Stimulus Duration on the Pure-Tone Threshold during Recovery from Auditory Fatigue.—J. F. Jerger. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 121–124.)

534.75 **1854**

Channels of Reception in Pitch Discrimination.—A. G. Pikler & J. D. Harris. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 124–131.) Experiments are reported indicating that, for subjects with normal hearing, the degree of pitch discrimination is the same for both ears, for binaural hearing, and for bone conduction.

534.75 **1855**

Pitch Perception for Certain Periodic Auditory Stimuli.—W. R. Thurlow & A. M. Small, Jr. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 132–137.) Report of experiments on the perception of pitch with pulsed tones.

534.78 **1856**

Transmission of the Vocal Cavities.—J. van den Berg. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 161–168.) "The transmission of the vocal cavities has been determined for eleven cardinal vowels of the I.P.A., using a hemilaryngectomized subject. A special throat loudspeaker with pick-up was constructed and was fitted in the throat of the subject, leaving a gap beneath it for normal breathing."

534.78 **1857**

Imitation of Dutch Vowels and Words by a Hemilaryngectomized Subject using a Throat Loudspeaker as a Pseudolarynx.—J. van den Berg. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 169–172.)

534.78 **1858**

An Instantaneous Pitch-Period Indicator.—L. O. Dolanský. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 67–72.) Circuit arrangements for analysing speech sounds are discussed. Marker pulses derived from the speech waveform are used to indicate the beginnings of the individual pitch periods.

534.845 **1859**

A Tentative Method for the Measurement of Sound Transmission Losses in Unfinished Buildings.—A. C. Raes. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 98–102.) An arrangement for testing the transmission properties of a wall under construction comprises a loudspeaker distant at least 6 ft from the wall and a microphone close to each side of the wall. Pure tones with exponentially increasing or decreasing amplitude are used. Results of measurements are reported for several types of construction.

621.395.623.64 **1860**

Factors determining the Sound Attenuation produced by Earphone Sockets.—J. Zwislocki. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 146–154.) Discussion of the design of earphone sockets to attenuate extraneous noise so far as possible without unduly reducing the transmission of sound from the earphone to the ear. Experiments indicate that for frequencies below 700 c/s the mass of the system and the impedance of the flesh under the earphone cushion are the limiting factors; for frequencies above 700 c/s bone conduction is the determining factor.

621.395.623.64 **1861**

Development of a Semiplastic Earphone Socket.—J. Zwislocki. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 155–161.) A headphone design combining comfort with high attenuation of extraneous noise is described.

621.395.623.7 **1862**

Theater Loudspeaker System incorporating an Acoustic-Lens Radiator.—J. G. Frayne & B. N. Locanthi. (*J. Soc. Mot. Pict. Telev. Engrs*, Sept. 1954, Vol. 63, No. 3, pp. 82–85. Discussion, p. 85.) Description of a loudspeaker with uniform distribution up to high frequencies over a wide horizontal angle, as required for the presentation of stereophonic sound. The radiator comprises arrays of elements similar to those used in microwave lenses, as discussed by Kock & Harvey (5 of 1950).

621.395.625.3 **1863**

'Wow' in Sound Reproduction Systems.—C. B. Sacerdote, M. Caciotti & G. Sacerdote. (*Onde élect.*, Jan. 1955, Vol. 35, No. 334, pp. 62–70.) Magnetic systems are considered. Wow and flutter are defined and methods of measurement described. Mechanical properties of tapes are discussed. Subjective tests of the threshold of perception for wow are mentioned. The effects of re-recording are examined.

621.395.625.3(083.74) **1864**

Absolute Measurement of Signal Strength on Magnetic Recordings.—R. Schwartz, S. I. Wilpon & F. A. Comerci. (*J. Soc. Mot. Pict. Telev. Engrs*, Jan. 1955, Vol. 64, No. 1, pp. 1–5. Discussion, p. 5.) The method under development involves the use of a non-magnetic loop to determine the absolute surface induction at 400 c/s. This single absolute measurement is then related to the corresponding relative surface-induction measurement, which is one of a series made over a range of frequencies up to about 6 kc/s.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.397.7 **1865**

Color-Television Coaxial Cable Termination and Equalization.—W. B. Whalley. (*J. Soc. Mot. Pict. Telev. Engrs*, Jan. 1955, Vol. 64, No. 1, pp. 8–12.) "This paper describes (*a*) the development of multi-element terminations to match the variation of cable impedance with frequency, (*b*) the design of networks to compensate for amplifier input capacitance, and (*c*) the provision of precise amplitude equalizers to compensate for cable attenuation."

621.315.212 : 621.397.7 : 621.317.3 **1866**

Evaluation of Pulse-Reflection Curves for determining the Length and True Magnitude of Inhomogeneities in Wide-Band Cables.—Krügel. (See 2052.)

621.372 : 621.315.6 **1867**

Investigations on Dielectric Waveguides in Rod or Tube Form.—P. Mallach. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 8–13.) Waveguides excited in an HE_{11} mode are investigated. The phase constant, attenuation, and spread of the external field are calculated for dielectrics with permittivity about 1·3, and the maximum concentration of field obtainable is estimated. Results obtained by direct measurement of the field are presented graphically, and suggestions are made for the design of low-loss supports for tubular waveguides.

621.372.8 **1868**

Propagation of Microwave through an Imperfectly Conducting Cylindrical Guide filled with an Imperfect Dielectric.—S. K. Chatterjee. (*J. Indian Inst. Sci.*, Section B, Jan. 1955, Vol. 37, No. 1, pp. 1–9.) General expressions are derived for the attenuation and phase constants for the hybrid wave EH_{11}.

621.372.8 **1869**

Transformation of a Frequency Equation in Corrugated-Waveguide Theory.—C. C. Grosjean. (*Nuovo Cim.*, 1st Jan. 1955, Vol. 1, No. 1, pp. 174–192. In English.) A procedure is described for simplifying the equation given by Walkinshaw (177 of 1949).

621.372.8 **1870**

Experimental Verification of a Frequency Equation for Corrugated Waveguides.—C. C. Grosjean & V. J. Vanhuyse. (*Nuovo Cim.*, 1st Jan. 1955, Vol. 1, No. 1, pp. 193–200. In English.) To verify the accuracy of the theory given by Grosjean (1869 above), measurements were made of the resonance frequency of a terminated iris-loaded guide, for various values of guide diameter and iris diameter. Explanations are advanced for discrepancies noted.

621.372.8 : 537.226 **1871**

Problems of Propagation in Cylindrical Systems.—M. Jouguet. (*Câbles & Transm.*, Jan. 1955, Vol. 9, No. 1, pp. 3–39.) General formulae are derived and are applied to the particular cases of (*a*) imperfectly conducting circular waveguide, (*b*) infinite wire conductor supporting surface waves, and (*c*) hollow dielectric cylinders; analysis indicates that in case (*c*) no wave can propagate. (EH) modes in two-dielectric lines are investigated; the $(EH)_{1,0}$ mode may have any frequency. See also 964 of 1954.

621.396.67 **1872**

The Skeleton Slot Aerial System. Designs for H.F. and V.H.F. Applications.—B. Sykes. (*Short Wave Mag.*, Jan. 1955, Vol. 12, No. 11, pp. 594–598.) For h.f., with purely resistive 500-Ω feed, design specifications given are: length/width ratio 3 : 1; ratio of width to conductor diameter 32 : 1; length of sides $0{\cdot}56\lambda$. An aerial for 18·5 Mc/s covers the 14–22-Mc/s band when tuned feeders are used; minimum conductor diameter is 1 in. Dimensions for bands between 7 and 44 Mc/s and between 115 and 530 Mc/s are listed. $\lambda/4$-stub matching is necessary in v.h.f. designs; optimum performance for stacked arrays is achieved with wavelength spacing. See also 2858 of 1954 (Dent).

621.396.67 : 517.512.2 **1873**

Further Investigations into Iterated Sine and Cosine Integrals and their Amplitude Functions with Reference to Antenna Theory.—E. Hallén. (*Kungl. tek. Högsk. Handl., Stockholm*, 1955, No. 89, 44 pp. In English.) Includes tables of functions discussed.

621.396.67.029.5 **1874**

Dual-Frequency Operation of a Loaded Vertical Medium-Frequency Radiator.—A. J. McKenzie, W. H. Hatfield & V. F. Kenna. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1955, Vol. 16, No. 1, pp. 4–11.) "A method is described for loading a vertical broadcasting aerial for optimum operation at two different frequencies. The design construction and adjustment of a radiator of this type for the Australian National System is discussed in detail."

621.396.673 **1875**

Input Resistance of L.F. Unipole Aerials with Radial Wire Earth Systems.—J. R. Wait & W. A. Pope. (*Wireless Engr*, May 1955, Vol. 32, No. 5, pp. 131–138.) The method described previously (334 of February) is extended to deal with aerials of length $< \lambda/4$ with top loading.

621.396.677.73 **1876**

The Propagation of Electromagnetic Waves in a Pyramidal Horn.—G. Piefke. (*Z. angew. Phys.*, Nov. 1954, Vol. 6, No. 11, pp. 499–507.) Analysis for a pyramidal horn of square cross-section is simplified by considering a nearly equivalent spherical pyramid. With an aperture semi-angle of 26·57° the field components for an H_{10} wave are evaluated exactly. Representing the curve at the aperture by a sine function gives a maximum error of 1%. In the distant field the wavelength is equal to the free-space wavelength and the field-strength amplitude decreases as $1/r$ for transverse components and as $1/r^2$ for longitudinal components, where r is measured from the apex. The longitudinal component increases with decreasing aperture angle or increasing order of wave mode. In the near field the wavelength rapidly approaches infinity in the direction of the apex; the smaller the aperture angle or the higher the wave mode the larger is the near-field amplitude and consequently the greater the attenuation through losses at the walls.

621.396.677.833.2 **1877**

Quasi-Fraunhofer Gain of Parabolic Antennas.—R. F. H. Yang. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 486.) A note showing how the measured gain varies with distance from the aerial for several assumed tapered aperture illuminations.

AUTOMATIC COMPUTERS

681.142 + 621-52 **1878**

I.V.A. [Royal Swedish Academy of Engineering Sciences] **Director's Annual Report on Progress in Research and Technology: Part 4—Computers and Automation.**—E. Velander. (*IVA, Stockholm*, 1955, Vol. 26, No. 2, pp. 36–45.) Includes a description of the BESK digital computer and notes on the industrial uses of computers and automation.

681.142 **1879**

Analogue Computation in the Service of Industry.—J. Hoffman. (*Rev. HF, Brussels*, 1954, Vol. 2, No. 12, pp. 321–340.)

681.142 **1880**

Coefficient Errors in Analogue Computers.—H. Fuchs. (*Wireless Engr*, May 1955, Vol. 32, No. 5, p. 142.) Brief analysis is presented facilitating assessment of the accuracy of individual computers.

681.142 **1881**

The Use of a Reflected Code in Digital Control Systems.—F. A. Foss. (*Trans. Inst. Radio Engrs*, Dec. 1954, Vol. EC-3, No. 4, pp. 1–6.)

681.142 **1882**

A Permanent High-Speed Store for Use with Digital Computers.—R. D. Ryan. (*Trans. Inst. Radio Engrs*, Sept. 1954, Vol. EC-3, No. 3, pp. 2–5.) Information is stored in the form of spots arranged in a co-ordinate grid on a slide, and is picked up by a flying-spot system. Reliable operation should be possible with a digit spacing of 1 μs if phosphors with low decay time are used. Advantages of the system are high storage density and commercial availability of the components.

681.142 **1883**

System Design of the SEAC and DYSEAC.—A. L. Leiner, W. A. Notz, J. L. Smith & A. Weinberger. (*Trans. Inst. Radio Engrs*, June 1954, Vol. EC-3, No. 2, pp. 8–23.) Standard design procedures developed during the work on the SEAC and DYSEAC digital computers cover (*a*) system specifications, (*b*) functional plans, and (*c*) wiring plans. Similarity between these design procedures and data-processing procedures carried out by such computers indicates that existing computers could be used to produce the wiring plans for new models.

681.142 **1884**

The Universal Relay-Computer (URR1) of the Institute for Low-Frequency Engineering at the Vienna Technische Hochschule.—H. Zemanek. (*Elektrotech. u. Maschinenb.*, 1st Jan. 1955, Vol. 72, No. 1, pp. 6–12.) The simple binary-scale digital computer described was primarily designed to demonstrate principles for the basic arithmetical operations and the extraction of roots. The input is via perforated tape, and electromechanical relays are used both in the store and the computer parts. The times required are 150 ms for addition and 4 sec for multiplication.

681.142 **1885**

Checking Codes for Digital Computers.—J. M. Diamond. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 487–488.)

681.142 : 538.221 **1886**

A Radio-Frequency Nondestructive Readout for Magnetic-Core Memories.—B. Widrow. (*Trans. Inst. Radio Engrs*, Dec. 1954, Vol. EC-3, No. 4, pp. 12–15.)

681.142 : 621.318.134 **1887**

New Ferrite-Core Memory uses Pulse Transformers.—W. N. Papian. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 194–197.)

681.142 : 621.372 **1888**

Asymmetrical Finite Difference Network for Tensor Conductivities.—L. Tasny-Tschiassny. (*Quart. appl. Math.*, Jan. 1955, Vol. 12, No. 4, pp. 417–420.) An extension of the technique described by Macneal (1331 of 1954).

CIRCUITS AND CIRCUIT ELEMENTS

621.314.7 : [621.318.57 + 621.373.52 **1889**

Junction-Transistor Trigger Circuits.—J. E. Flood. (*Wireless Engr*, May 1955, Vol. 32, No. 5, pp. 122–130.) The junction transistor with earthed emitter is sufficiently similar to the thermionic valve with earthed cathode to enable it to be used in conventional trigger circuits. Details are given of bistable, monostable and emitter-coupled trigger circuits, multivibrators, a scale-of-two circuit and a blocking oscillator. Pulses of duration down to about 10 μs can be produced. Power consumption is of the order of 1 mW per stage.

621.316.722.4 **1890**

Rotary and Slider Potentiometers with Variable Characteristic.—J. A. Reppich. (*Elektrotech. Z., Edn B*, 21st Jan. 1955, Vol. 7, No. 1, pp. 8–9.) Any resistance/slider-position characteristic can be approximated by connecting suitable resistors in parallel with short sections of the potentiometer.

621.316.8 : 621.396.822 **1891**

Investigations of Current Noise in Resistors.—H. Bittel & L. Storm. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 27–32.) Report of noise-voltage measurements over the frequency range 30 c/s–300 kc/s. With film resistors the mean square noise voltage usually varies approximately inversely as frequency; for resistors exhibiting such a frequency variation the noise is proportional to the direct voltage applied. Deviations from this frequency dependence are accompanied by deviations from this voltage dependence, as reported by Macfarlane (4087 of 1947). The behaviour of wire resistors is similar. The statistical distribution of amplitude of the current noise agrees with the distribution function for thermal noise, indicating that its nature is Gaussian.

621.318.43 **1892**

Linear Reactor Chart.—R. Lee. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 208, 210.) Design data are presented for iron-core reactors with inductance unaffected by variations of d.c. through the winding or alternating voltage across it.

621.318.57 : 621.327.42 : 535.215 **1893**

Light-Sensitive Neon-Tube Circuits.—J. Braunbeck. (*Radio-Electronics*, Jan. 1955, Vol. 26, No. 1, pp. 136, 138.) The decrease in the striking voltage and the slight increase in the dark current produced by external illumination in low-voltage (< 100 V) neon lamps is made use of in switching, l.f.-relaxation-oscillator, and other circuits. High-power illumination glow lamps may also be suitable.

621.372 **1894**

A Mathematical Technique for the Analysis of Linear Systems.—R. Boxer. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 489.) Comment on 363 of February (Ragazzini & Bergen).

621.372.412 : 621.314.7 **1895**

Calculation of the Oscillation Frequency of a Quartz Crystal maintained by a Transistor.—G. Briffod. (*C. R. Acad. Sci., Paris*, 21st Feb. 1955, Vol. 240, No. 8, pp. 841–842.) Calculations are made for high-Q and for low-Q crystals. Values of the frequency variation are tabulated for a range of values of detuning of the oscillator circuit connected to the transistor collector.

621.372.414.029.63 **1896**

An R.F. Resonant Circuit for Use at 300–1 000 Mc/s.—F. C. Isely. (*Tele-Tech & Electronic Ind.*, Jan. 1955, Vol. 14, No. 1, Section 1, pp. 60–62 .. 136.) Circuits of inductive-line type with a tuning range $>2:1$ have been designed without metallic sliding or rotating contacts. The construction may be of low-loss plastic, with plated or printed conductors. Eccentric 'coaxial' or two-wire arrangements are used.

621.372.5 **1897**

Understanding the Gyrator.—L. M. Vallese. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 483.) An equivalent Π-network is used to show that gyrators can be simply realized by means of current or voltage generators.

621.372.5 **1898**

RLC Lattice Transfer Functions.—A. D. Fialkow & I. Gerst. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 462–469.)

621.372.5 **1899**

A General Theory of Wideband Matching with Dissipative 4-Poles.—R. LaRosa & H. J. Carlin. (*J. Math. Phys.*, Jan. 1955, Vol. 33, No. 4, pp. 331–345.)

621.372.5 **1900**

Effect of a Radio Pulse Signal on Resonant Circuits.—J. Marique. (*Onde élect.*, Jan. 1955, Vol. 35, No. 334, pp. 55–61.) Calculations are made of the time required to establish the signal in a circuit of given bandwidth and time constant. It is not possible to establish any simple relation between these parameters except in the case when the signal frequency is the same as the resonance frequency. The influence of signal duration is studied. The results are of importance in connection with radiotelegraphy, and explain the occurrence of maxima at the beginning and end of each signal.

621.372.5 **1901**

Transformation for Constant-Impedance Networks.—H. J. Orchard. (*Wireless Engr*, May 1955, Vol. 32, No. 5, pp. 139–141.) "Certain constant-impedance networks having a restricted range of variation of loss often contain components which are difficult to manufacture. The transformation which is described overcomes this difficulty at the expense of two extra resistors in the network and a small amount of frequency-independent loss added to the characteristics. Another application is the absorption of inductor dissipation in special cases."

621.372.54.012 **1902**

A Chart for Analyzing Transmission-Line Filters from Input Impedance Characteristics.—H. N. Dawirs. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 436–443.) Use of Smith-chart techniques is demonstrated.

621.372.542 **1903**

Compilation of a Filter Catalogue.—E. Glowatzki. (*Frequenz,* Oct. 1954, Vol. 8, No. 10, pp. 296–299.) A discussion of the desirable features of a catalogue in which all numerical data required in designing reactance quadripoles by the insertion-loss method are assembled. An appendix gives formulae linking the reflection factor and four insertion-loss parameters. Values of the insertion-loss parameters are tabulated for values of reflection coefficient ranging from 0% to 100% in unit steps.

621.372.552 : 534.614-8 **1904**

Novel Uses of the Ultrasonic Light Cell.—Terry, Mumford & Holloway. (See 1850.)

621.373 **1905**

The Generation of Undamped Electrical Oscillations in Series and Parallel Oscillatory Circuits.—H. Pfeifer. (*Z. angew. Phys.,* Nov. 1954, Vol. 6, No. 11, pp. 508–510.) A formal analytical treatment showing the types of negative-resistance characteristic necessary for generating sinusoidal oscillations in the two types of circuit. See also 2602 of 1953 (Steimel).

621.373 **1906**

On the Extension of the Principle of Imaginary Power Balance of Harmonics to Circuits with Continuous Spectra.—J. Groszkowski. (*Bull. Acad. polon. Sci.,* Classe 4, 1954, Vol. 2, No. 3, pp. 131–135. In English.) Extension of the principles given in a previous paper on the interdependence of frequency variations and harmonic content in oscillators (*Proc. Inst. Radio Engrs,* July 1933, Vol. 21, No. 7, pp. 958–981).

621.373.4 **1907**

The Nonlinear-Theory Approach to Resistance-Capacitance Oscillators.—J. Groszkowski. (*Bull. Acad. polon. Sci.,* Classe 4, 1954, Vol. 2, No. 4, pp. 185–188. In English.) Exact calculations can be made using nonlinear theory based on the balance of the reactive power of the harmonics involved. The analysis indicates that the frequency stability when operating near the limit conditions is generally better with *RC* than with *CR* networks.

621.373.4 **1908**

The Influence of Grid Current upon Valve Oscillator Frequency.—L. Lukaszewicz. (*Bull. Acad. polon. Sci.,* Classe 4, 1954, Vol. 2, No. 4, pp. 177–180. In English.) Analysis indicates that when the intensity of harmonics in the oscillator anode and grid circuits is low, the fundamental component of grid current is the main factor influencing oscillation frequency. Grid-current harmonics have a greater influence than anode-current harmonics.

621.373.4 : 621.316.726 **1909**

Frequency Stabilization of Valve Oscillators in Respect of Grid Current, Amplification Factor and Load.—L. Lukaszewicz. (*Bull. Acad. polon. Sci.,* Classe 4, 1954, Vol. 2, No. 4, pp. 181–184. In English.) Formulae are derived for determining the values of stabilizing reactances for series connection in the grid, anode and load circuits.

621.373.4 : 621.365.55 **1910**

The Operation and Loading Characteristics of Valve Oscillators for Dielectric Heating.—V. L. Atkins. (*Electronic Engng,* March & April 1955, Vol. 27, Nos. 325 & 326, pp. 106–111 & 164–169.)

621.373.4.029.63 : 621.385.3 **1911**

Designing Stable Triode Microwave Oscillators.—J. G. Stephenson. (*Electronics,* March 1955, Vol. 28, No. 3, pp. 184–187.) Two circuit-constructional arrangements are described using a planar triode Type-2C40 and suitable respectively for operation at frequencies of 1–1·5 kMc/s and 3 kMc/s.

621.373.421 **1912**

Perturbations in Nonlinear Filtered Systems. Applications to the Theory of Oscillators.—V. Belevitch. (*Rev. HF, Brussels,* 1954, Vol. 2, No. 12, pp. 341–348.) Conventional methods of studying feedback-amplifier stability can be applied to 'separable' filtered systems comprising a nonlinear frequency-independent unit followed or preceded by a linear selective circuit [2044 of 1954 (Cahen) and back references]. The theory of free and synchronized modes is extended to the case of frequency division. Stability is investigated by introducing two different coefficients for the in-phase and quadrature components of the perturbation voltage, so that the system can be treated as an amplifier with two feedback loops. The method is applied to determine the effect on the output of a valve oscillator due to l.f. modulation at the grid.

621.373.43 : 621.385.15 **1913**

Pulse Generator using Secondary-Electron-Emission Valves.—E. Baldinger & M. Nicolet. (*Z. angew. Math. Phys.,* 15th Nov. 1954, Vol. 5, No. 6, pp. 508–511.) The generator described produces positive and negative voltage pulses with duration adjustable between 10^{-7} and 10^{-5} sec and a rise time of about $1{\cdot}3 \times 10^{-8}$ sec, as well as c.r.o. beam-brightening and sweep voltages.

621.373.44 **1914**

A Versatile Pulse Shaper.—K. E. Wood. (*Electronic Engng,* April 1955, Vol. 27, No. 326, p. 188.) Comment on 1294 of May (Kaufer).

621.373.52 **1915**

Transistor Waveform Generators.—F. Butler. (*Electronic Engng,* April 1955, Vol. 27, No. 326, pp. 170–173.) Design of circuits using point-contact and junction transistors is considered on the basis of analogies with thermionic-valve circuits. Experimental a.f. tuned-circuit, crystal-controlled and blocking oscillators are described.

621.374.43 **1916**

Fractional Frequency Generation by Regenerative Modulation.—D. Makow. (*Canad. J. Technol.,* Jan. 1955, Vol. 33, No. 1, pp. 41–55.) The circuit theory is similar to that presented previously for frequency multiplication (1295 of May). An arrangement is described producing six frequencies lower than input as well as others higher than input.

621.375.2 : 621.318.57 **1917**

A High-Speed Waveform-Sampling Circuit.—G. D. Bergman & D. M. MacKay. (*Electronic Engng,* April 1955, Vol. 27, No. 326, pp. 160–163.) Pulsed sampling circuits are discussed for obtaining a quantized output corresponding to a continuously varying input voltage. A cathode follower with negative feedback is used to provide an arrangement giving satisfactory operation with sampling pulses of short duration and small amplitude. A diode-switch circuit leads from the cathode follower to the input of a sign-reversing amplifier between whose input and output terminals the storage capacitor is connected.

621.375.2.029.3 **1918**

Design for a 20-Watt High-Quality Amplifier.—W. A. Ferguson. (*Wireless World*, May 1955, Vol. 61, No. 5, pp. 223–227.) Discussion with emphasis on the output stage and with special reference to the application of Type-EL84 output pentodes.

621.375.2.029.3 **1919**

Amplifiers and Preamplifiers.—C. G. McProud. (*Audio*, Jan. 1955, Vol. 39, No. 1, pp. 23–60.) "A practical discussion covering the operation, design, construction, and testing of all types of amplifiers used in home music systems, and a presentation of the interesting features of commercially available products."

621.375.221 **1920**

Selectivity and Delay Distortion in High-Frequency Amplifiers.—W. Nonnenmacher. (*Frequenz*, Oct. 1954, Vol. 8, No. 10, pp. 313–318.) In designing wide-band amplifiers or filters, a compromise must be reached between the conflicting requirements of linearity of phase characteristic, maximum amplification, and selectivity. Normalized curves for the attenuation, phase and transient-response characteristics of four different amplifiers with four tuned coupling circuits are presented and discussed from the point of view of design to meet specific requirements. The four types of amplifier considered are (*a*) those with single-tuned circuits, (*b*) those with flat phase characteristic, (*c*) power-law, and (*d*) Tchebycheff.

621.375.222 **1921**

Parallel-Series Amplifier.—R. Peretz. (*Rev. HF, Brussels*, 1954, Vol. 2, No. 12, pp. 349–358.) High amplification, stability and low output impedance are achieved in a direct-coupled circuit containing only two resistances, one in the common cathode lead of a parallel-connected double triode, the other, R_P, as the anode load of the first triode, whose anode is also connected directly to the grid of a third triode in series with the second. The output voltage is that between the anode of the second triode and the reference voltage input. Under appropriate conditions, amplification $A = -g_m R_P/2$, where g_m refers to the slope of the double triode. The operation of the circuit is analysed and its application as an amplifier for an analogue computer, a voltage stabilizer or a d.c. amplifier is described.

621.375.232 : [621.397.7 : 535.623 **1922**

Studio Amplifier Design for Color Television.—J. O. Schroeder. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 154–158.) Distribution amplifiers with highly linear phase characteristics over a wide frequency range are obtained by using multistage feedback amplifiers with *RC* couplings having different time constants.

621.375.3 **1923**

High-Speed Magnetic Amplifiers.—R. E. Wright. (*Electronic Engng*, April 1955, Vol. 27, No. 326, p. 188.) Comment on 670 of March (Maine). An alternative arrangement using a junction transistor for coupling is described.

621.375.3 **1924**

A Survey of Magnetic Amplifiers.—C. W. Lufcy. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 404–413.) Principles of operation and basic circuits are described, and applications are indicated.

621.375.4 : 621.314.63 **1925**

Diode Amplifier.—A. W. Holt. (*Radio-Electronic Engng*, Jan. 1955, Vol. 24, No. 1, pp. 18–19 . . 33.) See 987 of April.

621.376.332 : 621.372.2 **1926**

Delay Line Subcarrier Discriminator.—K. A. Morgan & R. F. Blake. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 203–205.) The frequency discriminator described uses a multivibrator triggered by the direct input signal and stopped by the delayed signal, producing pulses whose spacing is a function of signal phase. Designed primarily for telemetering, it is useful also for automatic correction of wow and flutter in tape recorders.

GENERAL PHYSICS

537.2 **1927**

An Electrostatic Problem involving a Non-linear Fluid Dielectric.—R. Cade. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 1–9.) "An approximate calculation is made of the electrostatic couple on an anisotropic dielectric sphere influenced by a uniform field and immersed in a slightly nonlinear fluid dielectric."

537.212 **1928**

Slit-Middle-Plate Capacitors: a Contribution to the Technique of Calculation of Potential Fields.—E. Kreyszig. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 13–17.) A numerical calculation is made for a system comprising two parallel plates distant respectively 8 cm and 4 cm on opposite sides of a third parallel plate with a slit 5 cm wide. The results are compared with electrolyte-trough measurements.

537.228.1 **1929**

Theory of the Diffusion of Light by Strongly Piezoelectric Crystals.—J. Chapelle & L. Taurel. (*C. R. Acad. Sci., Paris*, 14th Feb. 1955, Vol. 240, No. 7, pp. 743–745.) Expressions are derived for the variations of electric susceptibility produced in the crystal by passage of a wave of thermal agitation.

537.311.31 **1930**

Kinetic Temperature of Electrons in Metals and Anomalous Electron Emission.—V. L. Ginzburg & V. P. Shabanski. (*C. R. Acad. Sci. U.R.S.S.*, 21st Jan. 1955, Vol. 100, No. 3, pp. 445–448. In Russian.) The effect of strong electric fields on metals is to raise the temperature θ of the electrons above that of the lattice. The symmetrical part of the electron energy distribution is a Fermi distribution function; the asymmetric part is negligible in the cases considered. Quantitative estimates of the effect of the electron-temperature rise on conduction and emission are briefly discussed. See also 675 and 676 of March (Shabanski).

537.311.31 : 537.315.8 **1931**

Effect of Strong Electrostatic Fields on the Resistance of Tungsten Wires in High Vacua.—W. J. Deshotels & A. H. Weber. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 66–73.) Wires of diameter 0·004 and 0·0045 in. were subjected to negative and positive radial fields of strength up to 9×10^6 and $1{\cdot}4 \times 10^6$ V/cm respectively. The resistance decreased abruptly on applying the field and increased abruptly on removing it, regardless of its sign; the change of resistance was proportional to the square of the field strength. No explanation of the effect has been found. Slight increases of resistance during steady application of the field are associated with temperature increases attributed to effects of ion-, photo- and field-emission currents.

537.311.33 : 537.312.8 **1932**

The Theory of the Magnetoresistance Effects in Polar Semiconductors.—B. F. Lewis & E. H. Sondheimer. (*Proc. roy. Soc. A*, 7th Jan. 1955, Vol. 227, No. 1169, pp. 241–251.) Theory developed previously

621.385.032.216 **2159**

Evaporation of Barium and Strontium from Oxide-Coated Cathodes.—L. A. Wooten, A. E. Ruehle & G. E. Moore. (*J. appl. Phys.*, Jan. 1955, Vol. 26, No. 1, pp. 44–51.) Measurements are reported indicating that the rate of evaporation from filamentary cathodes is strongly affected by chemical reducing agents in the Ni support, as well as by the composition of the anode and grid, but is not affected by space current. No correlation is observed between the rate of evaporation and the thermionic activity of individual cathodes. The material evaporated from commercial cathodes is mainly Ba metal, and contains $< 5\%$ Sr, $< 2\%$ BaO, and $< 0{\cdot}01\%$ SrO.

621.385.032.216 **2160**

Heat Transfer through Oxide-Cathode Materials.—A. E. Pengelly. (*Brit. J. appl. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 18–20.) Measurements indicate a value of about $0{\cdot}4 \times 10^{-4}$ W.cm^{-1}. deg C^{-1} for the true thermal conductivity of typical oxide-cathode materials. The sum of the absorption and scattering coefficients estimated from the results is such that for a coating about 0·1 mm thick the fraction of the radiation leaving the base metal and passing straight through the coating is about 1/3 for BaO, about 1/9 for SrO, and considerably less for mixtures investigated.

621.385.1 **2161**

Valve Noise produced by Electrode Movement.—J. J. Glauber: P. A. Handley & P. Welch. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 488.) Comment on 1970 of 1954 and authors' reply.

621.385.3/.5 : 621.396.822 **2162**

The Nature of the Uncorrelated Component of Induced Grid Noise.—T. E. Talpey & A. B. Macnee. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 449–454.) Theoretical and experimental investigations indicate that a major portion of the uncorrelated component of induced grid noise is caused by fluctuations in the number of electrons reflected by the anode with sufficient energy to enable them to return through the grid. The corresponding change in the valve input admittance is discussed. A table shows measured values of induced grid noise for 11 typical receiving valves.

621.385.3.029.6 **2163**

Input Conductance of the Type-2C40 Disk-Seal Triode with Grounded Grid at U.H.F.—C. Colani. (*Frequenz*, Oct. 1954, Vol. 8, No. 10, pp. 293–296.) Comparison of the input conductance deduced from measurements at 2 kMc/s with the computed conductance shows that the actual values of transit angle are only about half those computed. Assuming a constant grid-cathode transit angle of 150°, measured and computed conductances are in good agreement. The usual transit-angle/mutual-conductance relation does not hold, probably because of island formation in front of the cathode.

621.385.832 **2164**

Infrared speeds Erasure of Dark-Trace Tubes.—F. Holborn & G. Hodowanec. (*Electronics*, Feb. 1955, Vol. 28, No. 2, pp. 170–171.)

621.385.832 **2165**

Measurement of the Luminescent-Screen Potential of Cathode-Ray Tubes.—W. Berthold. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 19–21.) The potential measured by an external e.s. attracted-filament voltmeter arrangement, in which the plate was constituted by the screen, was found to be in good agreement with results deduced from luminosity measurements.

621.385.832 **2166**

Beam-Hugging Plates for Unlimited Cathode Ray Deflection.—H. E. Kallmann. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 485.) C.r. tubes can be designed with long and closely spaced plates to have good deflection sensitivity without limiting the maximum deflection by using lateral pre-deflection and twisting the closely spaced plates.

621.385.832 : 537.533 : 535.37 **2167**

Secondary Emission from Luminescent Screens in Cathode-Ray Tubes.—K. H. J. Rottgardt, W. Berthold & H. Dietrich. (*Z. angew. Phys.*, Dec. 1954, Vol. 6, No. 12, pp. 560–563.) Experimental results indicate that the decrease of the sticking potential of a (ZnCd)S screen on irradiation by the beam electrons is probably due to removal of the adsorbed-gas surface layer. The sticking potential may be restored to its original value by introducing hydrogen but not by oxygen.

MISCELLANEOUS

621.3 : 061.1 **2168**

The 'Mark of Quality' for Electrical Engineering Materials and Equipment [in Italy].—P. Anfossi. (*Ricerca Sci.*, Feb. 1955, Vol. 25, No. 2, pp. 234–243.) Note on the inauguration of an institute having authority to issue 'Mark-of-Quality' certificates to manufacturers of electrical equipment.

621.3 : 061.3 **2169**

1955 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 347–377.) Includes abstracts of the papers presented.

621.39(44) **2170**

Brief Account of the C.N.E.T. [Centre National d'Études des Télécommunications].—(*Électronique, Paris*, March 1955, No. 100, pp. 25–29.) The C.N.E.T. is an interdepartmental research organization administered by the French Post Office but including sections serving all the other government departments with an interest in telecommunications. The documentation service covers a wide field and is responsible for the publication of *Les Annales des Télécommunications* as well as an internal journal.

621.396 : 378.9 **2171**

Education and Training of Radio Engineers.—E. Williams. (*Nature, Lond.*, 12th Feb. 1955, Vol. 175, No. 4450, pp. 279–280.) Report of discussion at a meeting of the British Institution of Radio Engineers. See also *J. Brit. Instn Radio Engrs*, March 1955, Vol. 15, No. 3, pp. 154–160.

413 = 00 + 621.3(083.73) **2172**

International Electrotechnical Dictionary. [Book Review]—Publishers: International Electrotechnical Commission, Geneva, 70 pp., S.Fr.8. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, p. 62.) Part 1 comprises 70 pages of alphabetically arranged terms and definitions in French and English together with translations of the terms into German, Italian, Spanish, Polish and Swedish. Part 2 comprises indexes in the seven languages.

621.38 **2173**

Advances in Electronics, Vol. V. [Book Review]—L. Marton (Ed.). Publishers: Academic Press, New York and Academic Books, London, 1953, 420 pp., $9.50 or 76s. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 59–60.) This volume contains eight review articles, including one on steady-state theory of the magnetron and one on colour television.

ends of two short-circuited Lecher wires. This combination forms a resonant structure. With a suitably chosen electron velocity, the valve acts as an oscillator. Outputs of some tens of milliwatts were obtained in the range 72–130 cmλ.

621.385.029.63/.64 **2150**

The Mitron—an Interdigital Voltage-Tunable Magnetron.—J. A. Boyd. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 332–338.) The magnetron described is tunable in the range 1·5–3·5 kMc/s by varying the anode potential; it is associated with an external cavity and is adaptable to mounting in a waveguide structure. It has an output of about 200 mW and can be used for measurement purposes or as local oscillator for a microwave receiver. A pure tungsten cathode gives better operation than either an oxide-coated or a thoriated-tungsten cathode. The high power output depends on keeping the anode-to-anode capacitance low and the external circuit impedance high.

621.385.029.63/.64 **2151**

Application of Recurrent-Network Equivalent Circuit in determining the Attenuation of Helical Transmission Lines loaded by Resistive Coatings.—M. Müller. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 29–34.) The line considered comprises a conducting helix of radius a, a coaxial resistive cylinder of radius b and a coaxial conducting cylinder of radius d, where $d > b > a$. Characteristics calculated using the formulae derived are in good agreement with experimental characteristics of travelling-wave valves obtained by Webber (2378 of 1950). The analysis also shows that the resistance required for maximum attenuation is proportional to the delay of the line and that the specific attenuation depends strongly on the separation $(b–a)$.

621.385.029.63/.64 **2152**

History, Classification and Physics of Very-High-Frequency Electron Valves.—W. Kleen. (*Elektrotech. Z., Edn A*, 1st Jan. 1955, Vol. 76, No. 1, pp. 53–64.) Valves for frequencies above 1 kMc/s are surveyed. 52 references.

621.385.032.2 : 537.533 **2153**

Pin-Hole Camera Investigation of Electron Beams.—C. C. Cutler & J. A. Saloom. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 299–306.) The technique described is useful in designing guns for high-density beams. Transverse distribution of density and velocity are investigated by passing the beam through a pinhole aperture followed by a current detector which may consist of a fluorescent screen or a further aperture associated with a collector. Results of observations on some Pierce-type guns are reported; various arrangements of beam-forming auxiliary electrodes are illustrated. At high perveance values bombardment of the cathode by positive ions may be serious. Initial transverse velocity components are the fundamental cause of nonideal flow.

621.385.032.2 : 537.533 **2154**

Thermal Velocity Effects in Electron Guns.—C. C. Cutler & M. E. Hines. (*Proc. Inst. Radio Engrs*, March 1955, Vol. 43, No. 3, pp. 307–315.) The effects are studied theoretically in relation to the experimental work on Pierce-type guns described by Cutler & Saloom (2153 above). Expressions are derived for the beam spread resulting from the transverse velocities and for the magnification produced by the pinhole device.

621.385.032.213 **2155**

Patch Effect for the Thermionic Emission from Polycrystalline Tantalum.—W. B. LaBerge, R. J. Munick, J. A. Dezoteux, J. F. Whalen & E. A. Coomes. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 241–243.) Schottky plots for d.c.-aged Ta filaments exhibit breaks at high as well as low field strength. D.c. etch patterns on certain faces of the crystal grains appear at the higher break point. The results are discussed in the light of theory given by Herring & Nichols (3407 of 1949).

621.385.032.213 **2156**

Electron Velocities with the Hollow Cathode.—W. Veith. (*Naturwissenschaften*, Jan. 1955, Vol. 42, No. 2, pp. 40–41.) Experiments were made using a special valve with a cathode acting simultaneously as an emitter of usual type and as a hollow cathode. The results confirm that electron velocities much greater than ordinary emission velocities occur within the hollow cathode.

621.385.032.216 **2157**

International Congress to mark the Fiftieth Anniversary of the Oxide Cathode.—(*Le Vide*, Jan. 1955, Vol. 10, No. 55, pp. 318–400.) The text is given of the following further papers:—

- Long-Life Valves (pp. 318–335).—W. Dahlke. German version included.
- Long-Life Oxide-Coated Cathodes (pp. 336–339).—S. Takada & S. Fujino. English version included.
- The Oxide Cathode in Very-Long-Life Valves (pp. 340–346).—G. Saintesprit & P. Meunier.
- Comparison of Thoria Cathodes and Alkaline-Earth Oxide Cathodes (pp. 347–351).—G. Mesnard.
- Semiconductor Properties of the Thoria Cathode (pp. 352–354).—S. Takahashi. English version included.
- Thoriated Tungsten Cermet Cathode for Pulse Magnetrons (pp. 355–359).—L. J. Cronin. English version included.
- Statistical Observation of the Performance of Oxide-Cathode Valves in the French Long-Distance Telephone System (pp. 360–361).—J. Eldin.
- Poisoning of Oxide Cathodes (pp. 362–365).—H. Penotet.
- Failure of Emission from Oxide Cathodes (pp. 366–379).—K. Amakasu, T. Imai & M. Asano. English version included.
- Influence and Measurement of the Degree of Vacuum in Oxide-Cathode Valves (pp. 380–383).—J. Bailleuil-Langlais.
- Deterioration of the Oxide Cathode by Evolution of Gas from the Anode under Electron Bombardment (pp. 384–393).—T. Imai. English version included.
- Determination of the Sulphur Content in Nickel (pp. 394–400).—T. R. Andrew & C. H. R. Gentry. English version included.

For previous list see 1526 of May.

621.385.032.216 **2158**

Measurement and Theoretical Study of Electrical Conductivity and Hall Effect in Oxide Cathodes.—R. Forman. (*Phys. Rev.*, 15th Dec. 1954, Vol. 96, No. 6, pp. 1479–1486.) Results of measurements over the temperature range 500°–1 000°K indicate that the Hall coefficient is negative, with a maximum between 600° and 800°. Electron mobility is high at temperatures over 700° and decreases rapidly with decreasing temperature. Magnetoresistive effects were observed, of intensity depending on temperature and on the porosity of the cathode. The results are consistent with the porous semiconductor model proposed by Loosjes & Vink (3208 of 1950).

621.383.2 : 546.36.86 **2136**

Relation of Antimony Transmission and the Photoelectric Yield of Cs-Sb.—M. Rome. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 166–169.) The investigation reported is relevant to the control of the thickness of semitransparent Cs-Sb photocathodes in accordance with their optical transmission. Results of transmission measurements on Sb films of different thicknesses are shown graphically for blue, red and white illumination. Discontinuities in the curves appear at a phase change in the Sb, when the transmission is about 30%. The Sb films were next activated with Cs, and measurements were made of the photoelectric yield. For reverse illumination the peak response occurs with films of thickness corresponding to 5·5–6 μg/cm^2.

621.383.42 **2137**

Photoelectric Effect in Selenium Photocells at Low Temperatures.—G. Blet. (*C. R. Acad. Sci., Paris*, 28th Feb. 1955, Vol. 240, No. 9, pp. 962–963.) Measurements have been made over the range 88°–295°K. For a given excitation wavelength the sensitivity varies in the same sense as the temperature. For a given temperature, the sensitivity/wavelength characteristic passes through a maximum.

621.383.5 **2138**

InSb Photovoltaic Cell.—G. R. Mitchell, A. E. Goldberg & S. W. Kurnick. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 239–240.) Measurements are reported on a *p-n*-junction cell produced by crystal-pulling technique. Noise spectra are shown for the cell at 77°K, (*a*) exposed to room-temperature radiation, and (*b*) shielded.

621.383.5 : 546.23 : 538.639 **2139**

Photomagnetoelectric Effect in Selenium Barrier-Layer Photocells.—G. Blet. (*C. R. Acad. Sci., Paris*, 14th Feb. 1955, Vol. 240, No. 7, p. 743.) When a magnetic field is applied parallel to the plane of the illuminated cell, the current decreases; the effect becomes more marked as the excitation wavelength increases.

621.385.001.4 **2140**

Quality Screening for Audio-Frequency Impulse Noise and Microphonism.—Wohl & Winkler. (See 2070.)

621.385.002.2 : 621.365.54 **2141**

High-Frequency Induction Heating.—(See 2078.)

621.385.029.6 **2142**

Concerning the Noise Figure of a Backward-Wave Amplifier.—T. E. Everhart. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 444–449.) Calculations show that the minimum noise figure is about the same for the backward-wave amplifier as for the ordinary travelling-wave valve, i.e. about 6 db. Results of measurements of noise figure as a function of gain support the theory.

621.385.029.6 **2143**

The "M"-Type Carcinotron Tube.—R. R. Warnecke, P. Guénard, O. Doehler & B. Epsztein. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 413–424.) The magnetron-type carcinotron is investigated theoretically and experimentally. By taking account of space charge, the theory is brought into agreement with experimental results on starting current, variation of efficiency with coupling impedance, and parasitic oscillations. The 'rising-sun' effect is observed as in ordinary magnetrons. Figures obtained for a valve with the line curved into a circle and with permanent-magnet focusing indicate that power output of several hundred watts is obtainable over a frequency band greater than half an octave in the 3-kMc/s region. See also 1828 of June (Epsztein).

621.385.029.6 **2144**

Method for Measurement of Ripple in Electron Beams.—J. Berghammer. (*Frequenz*, Jan. 1955, Vol. 9, No. 1, pp. 25–28.) A sliding diaphragm with parallel-sided slit is used; this arrangement does not require highly accurate centring with respect to the electron beam. A brief description is given of the special valve used for the measurements, and some results are presented.

621.385.029.6 **2145**

Power Flow in Electron Beam Devices.—W. H. Louisell & J. R. Pierce. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 425–427.) A formula for the power flow at low signal levels is derived which includes the contribution corresponding to the Poynting vector and that corresponding to the kinetic energy of the electrons.

621.385.029.6 **2146**

On the Possibility of Amplification in Space-Charge-Potential-Depressed Electron Streams.—W. R. Beam. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 454–462.) A more rigorous analysis is presented for the single ribbon beam than that of Kent (1945 of 1954). The results confirm that no growing waves can be produced in single-beam v.m. valves, even with the velocity distribution corresponding to the presence of space charge. This conclusion is also confirmed by measurements of the amplitude of space-charge waves at points along a drift tube. Where gain is observed, it is probably due to interaction of the beam with a second electron stream produced by reflection at a low-potential collector and again in the region of the gun.

621.385.029.6 **2147**

Modes and Operating Voltages of Interdigital Magnetrons.—A. Singh. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 470–476.) Methods are discussed for obtaining operation over a desired frequency spectrum, with particular attention to modes of non-zero order. The relation between the frequencies of various modes and the resonator parameters was investigated experimentally. The consequences of phase reversal at certain locations in the anode are analysed; use of phase-shifting fingers as described by Crawford & Hare (2987 of 1947) does not ensure operation at only one voltage for one mode. A more effective method is to use a large number of fingers without phase reversal.

621.385.029.6 : 538.691 **2148**

Relativistic Dynamics of a Charged Particle in Crossed Magnetic and Electric Fields with Application to the Planar Magnetron.—L. Gold. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 253–254.) Correction to papers abstracted in 3203 and 3401 of 1954.

621.385.029.62/.63 **2149**

A Magnetless "Magnetron".—A. Versnel & J. L. H. Jonker. (*Philips Res. Rep.*, Dec. 1954, Vol. 9, No. 6, pp. 458–459.) The valve comprises two coaxial cylindrical electrodes, with the outer one at a lower potential and an electron gun between them. The inner electrode is divided into an even number of longitudinal strips, the ends of alternate strips being connected to two points on the cylinder axis, which are in turn connected to the

621.397.621 : 621.375.232 **2121**

Feedback I.F. Amplifiers.—J. Rasmussen & P. V. Iversen. (*Wireless World*, May 1955, Vol. 61, No. 5, p. 213.) Comment on 568 of February (Jewitt). In i.f. amplifiers for television the valve and circuit losses are not negligible and design calculations should therefore be based on the formulae for the Π network. Experimentally determined selectivity curves for a feedback and a stagger-tuned amplifier using the calculated values of components are shown.

621.397.7 : 535.623 **2122**

Subject-Lighting Contrast for Color Photographic Films in Color Television.—F. T. Percy & T. G. Veal. (*J. Soc. Mot. Pict. Telev. Engrs*, Sept. 1954, Vol. 63, No. 3, pp. 90–94.)

621.397.8 **2123**

Quality Characteristics of Television Pictures.—E. Menzer & H. Voelkel. (*Elektrotech. Z., Edn B*, 21st Jan. 1955, Vol. 7, No. 1, pp. 13–19.) Various picture faults are illustrated and their causes are briefly discussed.

TRANSMISSION

621.396.61 **2124**

Modern Fifty-Kilowatt Broadcast Transmitter.—W. M. Witty. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 168–169.) Features of the transmitter are (*a*) use of a Doherty amplifier modified for grounded-grid operation, and (*b*) use of a 5-kW driver which is itself a complete transmitter, with switching arrangements for reduced-power operation.

621.396.61 : 621.396.932 **2125**

Circuit and Operation of Emergency Transmitters.—H. Geschwinde & E. Hüttmann. (*Nachr-Tech.*, Jan. 1955, Vol. 5, No. 1, pp. 38–40.) An East German two-valve automatically-keyed 80-W marine emergency transmitter for the frequency band 410–500 kc/s is discussed. Use of a 220-V 500-c/s supply for anode and screen, obtained from a 24-V battery via a converter and transformer, results in the production of sidebands at ± 500 c/s of the carrier frequency. Carrier suppression is obtained by connecting the grids of the two pentodes in push-pull and the anodes in parallel.

VALVES AND THERMIONICS

621.314.63 **2126**

Anomalous Forward Switching Transient in *p-n* Junction Diodes.—N. T. Jones, R. H. Kingston & S. F. Neustadter. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 210–213.) "A delay in the flow of forward current when a grown-crystal *p-n* junction diode is switched from reverse to forward bias is explained on the basis of an extra *p-n* barrier in the grown-crystal bar. This effect was observed in 10 out of 24 production units, while no such anomaly was found in fused-junction diodes. A mathematical theory of the effect gives good agreement with the experimental results."

621.314.63 **2127**

Measurement of Minority Carrier Lifetime and Surface Effects in Junction Devices.—S. R. Lederhandler & L. J. Giacoletto. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 477–483.) A current pulse in the forward direction is applied to a *p-n* junction, injecting minority carriers. At the end of the pulse the junction is open-circuited by means of a thermionic diode, and the voltage decay characteristic is observed. The method is useful for measurements on junction devices in course of manufacture, and permits estimation of absolute values of surface recombination velocity. See also 887 of 1954 (Gossick).

621.314.63 : 537.311.33 **2128**

Planar [-junction] **Germanium Diodes.**—A. Puzhai. (*Radio, Moscow*, Jan. 1955, No. 1, pp. 27–28.) Current/voltage characteristics for temperatures of 20°, 50° and 70°C are given of four Russian-made In/Ge junction diodes. A section drawing of their construction is also shown.

621.314.63 : 546.28 **2129**

Silicon Alloy Junction Diode as a Reference Standard.—D. H. Smith. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954, Vol. 73, pp. 645–651. Digest, *Elect. Engng, N.Y.*, Jan. 1955, Vol. 74, No. 1, Section 1, p. 43.) Results of measurements on a number of Si junction diodes indicate that they can serve as low-voltage reference sources when biased beyond saturation point in either the forward or the reverse direction. Specimens with reverse saturation voltages of 4–6 V are suitable, having low characteristic slope and low temperature coefficient of slope.

621.314.63 : 546.28 **2130**

High-Voltage Silicon Diodes.—L. G. Rubin & W. D. Straub. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 490.) Characteristics of some experimental grown-junction diodes are presented. Performance comparable to that of valve rectifiers can be obtained using high-resistivity Si.

621.314.632 + 621.314.7 **2131**

Double Base expands Diode Applications.—J. J. Suran. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 198–202.) See 2535 of 1954 (Aldrich & Lesk).

621.314.632 : 546.289 **2132**

Long-Period Effects in Germanium Crystal Rectifiers.—M. Kikuchi. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 665–670.) Measurements were made, using a pendulum switching technique, on some fifty Type-1N34 diodes illuminated by a tungsten lamp. 60–70% exhibited all three of the following phenomena: (*a*) photo-after-effect [2794 of 1954 (Kikuchi & Onishi)]; (*b*) current creep; (*c*) photocurrent creep. The remainder showed none of these effects. Typical decay curves exhibit two distinct phases with characteristic time constants of 30–50 sec and 200–300 sec respectively. The effects are explained as due to traps, not necessarily at the surface of the crystal, and possibly produced by electrical forming.

621.314.7 + 621.314.63 **2133**

Intrinsic Barrier Transistor.—W. C. Hittinger, J. W. Peterson & D. E. Thomas. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 487.) Brief note of the performance of experimental *p-n-i-p* transistors [2799 of 1954 (Early)]. A unit oscillating stably at 465 Mc/s has been produced. Corresponding results were obtained with *p-i-n* diodes.

621.314.7.001.4 **2134**

A Point-Contact Transistor Test Set.—R. S. Hill. (*Elect. Engng, N.Y.*, Jan. 1955, Vol. 74, No. 1, Section 1, pp. 59–62.) Detailed operating instructions are presented relative to the tests described by Wooley (1092 of April).

621.314.7.012.6 : 621.317.755 **2135**

Displayed Transistor Characteristics.—H. W. Loeb & N. W. Morgalla. (*A.T.E. J.*, Jan. 1955, Vol. 11, No. 1, pp. 38–48.) A c.r.o. characteristic-curve tracer is described and some of the design considerations are discussed.

621.396.44 **2107**

Short-Haul Carrier-Current Systems.—J. Jacot. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Jan. & 1st Feb. 1955, Vol. 33, Nos. 1 & 2, pp. 8–17 & 70–83. In French.) A review of systems in use or under development in Europe and the U.S.A. The manner in which various factors affect the choice of a particular system is indicated.

621.396.5 : 621.311.6 **2108**

Battery-Powered Subscribers' Radio Telephone.—N. A. Lockley & R. A. Glover. (*A.T.E. J.*, Jan. 1955, Vol. 11, No. 1, pp. 62–74. Digest, *Elect. J.*, 21st Jan. 1955, Vol. 154, No. 3, p. 203.) Lightweight f.m. radiotelephone equipment with normal dialling facilities is described, for operation at frequencies between 54 and 88 Mc/s. A 12-V accumulator is used, 90 and 120 V h.v. being obtained by means of a vibrator unit. Cyclic switching reduces the stand-by consumption to 2·16 Ah per day. A r.f. output of 500 mW ensures reliable operation over a distance of 17–20 miles. In use the equipment and accumulator are mounted on the aerial pole and connected by a two-wire line to the subscriber's instrument. An a.m. system operating at 160 Mc/s is also briefly described.

621.396.61/.62 **2109**

Two-Way U.H.F. Pack Set uses Helmet Antenna.—D. C. Jensen & M. Schwartz. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 150–153.) A compact 23-valve transmitter/receiver Type-AN/PRC-14, for military use, is described. Operation is in the band 225–400 Mc/s; about 1 750 channels are available, but only one of four pre-set crystal-controlled frequencies can be selected at a time. Ground-to-air communication over a distance of 110 miles has been achieved.

621.396.65.029.63 **2110**

P.P.M. Radio-Link Equipment.—O. Laaff & O. Bettinger. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 43–48.) Equipment for the frequency range 2·1–2·3 kMc/s is briefly described with block diagrams.

621.396.712.2 : 534.86 **2111**

Broadcasting-Studio Engineering—today and tomorrow.—E. Vogl. (*Radio Tech., Vienna*, Jan. 1955, Vol. 31, No. 1, pp. 3–7.) Both centralized and decentralized studio control systems are briefly discussed; the latter system is the one preferred in Austria. The gain/frequency characteristic of the studio amplifiers should be adjustable, so that the apparent loudness/frequency characteristic of the original can be reproduced at a given intensity level.

621.396.931 **2112**

Single Sideband for Mobile Communication.—A. Brown & R. H. Levine. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1955, Vol. 16, No. 1, pp. 12–17; *Convention Record Inst. Radio Engrs*, 1953, Part 2, pp. 123–128.) The advantages of the s.s.b. system are indicated and simple arrangements are described.

SUBSIDIARY APPARATUS

621-526 **2113**

Three Examples of Electrical-Servomechanism Engineering.—E. Gerecke. (*Z. angew. Math. Phys.*, 15th Nov. 1954, Vol. 5, No. 6, pp. 443–465.) Servomechanism system design problems treated by graphical methods, which are explained, include regulation of the output voltage of a constant-speed independently excited d.c. generator and two cases of motor speed control.

621.314.63 **2114**

Component Design Trends—Metallic Rectifiers approach Infinite Life.—F. Rockett. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 162–166.) Developments in Cu_2O, Se, Si, Ge and TiO_2 rectifiers are surveyed; new designs give reduced size and longer life together with higher operating-temperature, output-current and reverse-voltage ratings.

621.316.722.078.3 **2115**

Highly Stable Medium-Voltage Direct and Alternating Sources for Test Purposes.—H. Helke & R. Stenzel. (*Z. angew. Phys.*, Nov. 1954, Vol. 6, No. 11, pp. 521–528.) A review of methods of stabilizing supply voltages up to about 1 kV, and a note on methods of measuring small changes of alternating voltage. See also 2227 of 1954 (Helke).

621.316.722.1 **2116**

A Cascode Amplifier Degenerative Stabilizer.—V. H. Attree. (*Electronic Engng*, April 1955, Vol. 27, No. 326, pp. 174–177.) Description of stabilizers with modified-cascode shunt amplifiers having gain > 1000.

621.319.3 **2117**

Generation of High Voltage by Charge Transport on Rotating Insulator Surfaces.—W. Herchenbach. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 32–43.)

TELEVISION AND PHOTOTELEGRAPHY

621.397.2 : 621.376.53 **2118**

System for the Transmission of Two [television] **Programmes Simultaneously or of a Colour Signal.**—G. A. Boutry, P. Billard & L. Le Blan. (*Onde élect.*, Jan. 1955, Vol. 35, No. 334, pp. 5–21.) Two-channel p.a.m. is used in a dot-sequential system, the pulses in the combined signal being alternately positive and negative as described previously [1176 and 1561 of 1954 (Le Blan)] so as to double the overall channel capacity. Diode separators are used at the receiver. Methods for reducing crosstalk are discussed.

621.397.61/.62 **2119**

Russian Colour Television.—(*Wireless World*, March 1955, Vol. 61, No. 3, pp. 127–128.) A digest is presented of recently published accounts of the Moscow experimental colour-television transmitter and of the colour-television receiver 'Raduga'. A 525-line frame-sequential system operating in the 76–88-Mc/s band is used; the 150 single-colour frames per second give 25 line-interlaced colour pictures per second. The transmitter is described by N. Belyaev in *Radio, Moscow*, May 1954, No. 5, pp. 31–32, the receiver by V. Semenov & N. Baldin, *ibid.*, May 1954, No. 5, pp. 33–35, and Nov. 1954, No. 11, pp. 32–36 (where a complete circuit diagram and constructional details are given), and Dec. 1954, No. 12, pp. 37–40 (alignment procedure). In an article by K. Sergeichuk entitled 'Contemporary Radio Technique' (*Radio, Moscow*, April 1955, No. 4, pp. 5–7) it is indicated that a compatible colour-television system using a three-colour tube is under development.

621.397.62 : 621.314.7 **2120**

Transistorized Portable [television] **Receiver.**—G. B. Herzog & R. D. Lohman. (*Radio-Electronics*, Jan. 1955, Vol. 26, No. 1, pp. 43–45.) This experimental receiver is designed for single-channel reception at 67·25 Mc/s. It uses a superheterodyne circuit, with no r.f. stage. Transistors and crystal diodes replace thermionic valves throughout. Circuit diagrams are shown and the operation is described. The power input requirement of 13 W includes 3·6 W for the Type-5FP4 c.r. tube heater. The total weight is 27 lb.

A summary is presented of published experimental results and of some previously unpublished work on propagation in the frequency range from about 100 Mc/s to 3 kMc/s. The results are extended, by calculation, down to 30 Mc/s. For a continuous wood the attenuation is of the order of 0·02 db/m at 30 Mc/s rising to about 0·5 db/m at 3 kMc/s. Below 1 kMc/s the attenuation rate is slightly greater with vertical polarization than with horizontal polarization. For single obstacles, such as a tree or a building, diffraction effects result in considerable spatial variations of field-strength in the shadow region.

621.396.812.3 : 621.39.001.11 **2095**

Information Theory Aspects of Propagation through Time-Varying Media.—Feinstein. (See 2103.)

RECEPTION

621.396.62.029.62 : 621.376.333 **2096**

Design for an F.M. Tuner.—S. W. Amos & G. G. Johnstone. (*Wireless World*, April & May 1955, Vol. 61, Nos. 4 & 5, pp. 159–163 & 216–222.) The tuner, designed for the B.B.C. v.h.f. service, to cover the 87·5–100-Mc/s frequency range, uses a ratio-detector; reasons for preferring this to the Foster-Seeley discriminator are given. A complete circuit diagram, lists of components and layout photographs are presented, and the operation and constructional details are discussed in some detail.

621.396.621 **2097**

The Siemens S.S.B. Receiver KW2/6.—E. Schulz, D. Leypold & H. Schreiber. (*Frequenz*, Oct. 1954, Vol. 8, No. 10, pp. 306–313.) Designed for long-distance reception of telephony in two independent channels on either side of a suppressed carrier or for s.s.b. reception of d.s.b. transmissions. Two models cover the ranges 2·5–20 Mc/s and 4–28 Mc/s respectively. Frequency constancy of $\Delta f/f < 10^{-7}$ is achieved.

621.396.621 + 621.317.3] : 621.396.822 **2098**

On Power Spectra and the Minimum Detectable Signal in Measurement Systems.—Freeman. (See 2053.)

621.396.621 : 621.396.822 **2099**

The Effect of a Random Noise Background upon the Detection of a Random Signal.—H. S. Heaps. (*Canad. J. Phys.*, Jan. 1955, Vol. 33, No. 1, pp. 1–10.) "A noise distributed in phase and power according to a Rayleigh law is studied in terms of its effects upon the detectability of a signal of similar phase and amplitude distribution. An expression is derived for the probability distribution of the ratio of the power of the signal plus noise to that of the noise in the absence of the signal. The corresponding result is given for the ratio of the averages over several observations. Also derived is the probability distribution of the fractional change in noise plus signal power due to a given fractional change in signal power."

621.396.621.54 : 621.314.7 **2100**

Design of Transistorized High-Gain Portable.—W. E. Sheehan & J. H. Ivers. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 159–161.) An 8-transistor superheterodyne receiver is described, capable of delivering 100 mW undistorted output.

STATIONS AND COMMUNICATION SYSTEMS

621.376.55 : 621.396.41 **2101**

Modulator Equipment for a 24-Channel P.P.M. System.—K. Steinbuch, H. Endres & H. Reiner. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 38–43.)

621.39.001.11 **2102**

Effect of Heisenberg's Principle on Channel Capacity.—R. J. Solomonoff. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, p. 484.) Analysis shows that the value found for the energy necessary to transmit one bit of information is not appreciably increased by introducing quantum-mechanics considerations.

621.39.001.11 : 621.396.812.3 **2103**

Information Theory Aspects of Propagation through Time-Varying Media.—J. Feinstein. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 219–229.) "The channel capacity of a communications system which utilizes wave propagation through a time-varying medium such as the ionosphere or troposphere is evaluated in terms of the statistical properties of the medium and of the noise. The signal fading in such a system reduces the capacity. Rayleigh fading is found to give rise to an equivalent signal to noise ratio of 1·72, while shallow fading of the Gaussian type augments the noise in the channel by a fraction of the signal power proportional to the fading depth. An optimum manner of band width subdivision is shown to exist when selective fading is present. Information theory concepts are broadened to include the possibility of multiple reception at spaced receiving sites, and the consequent increase in theoretical channel capacity is computed as a function of the number of such sites and the signal statistics. The method of maximum likelihood is utilized to obtain optimum combinatorial laws for the multiple signals. The commonly employed maximum signal selection diversity system is shown to perform as well as the optimum system in the presence of Rayleigh fading, for a small number of receiving sites."

621.395.66 : 621.385.4/.5 **2104**

Automatic Valve-Emission Monitor.—J. Boura. (*A.T.E. J.*, Jan. 1955, Vol. 11, No. 1, pp. 49–51.) A monitoring system applicable to multichannel carrier systems is described. The rise in screen potential due to a decrease in cathode emission is used to operate an alarm. The basic circuit of the monitor and alarm is described; a miniature cold-cathode metering diode is used.

621.396.41 **2105**

Radio-Link Transmission with Reference to International Recommendations for Long-Distance [telephone] **Communication.**—H. Werrmann. (*Elektrotech. Z., Edn A*, 1st Jan. 1955, Vol. 76, No. 1, pp. 64–72.) A discussion of multichannel radiotelephone systems, and the various modulation methods used, with particular reference to the limitations imposed by noise. A brief account is also given of C.C.I.R. and C.C.I.F. recommendations made at Geneva in 1954, on standardization of equipment. See also *Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Jan. 1955, Vol. 33, No. 1, pp. 35–38.

621.396.41.029.64 : 621.376.3 **2106**

Method for improving the Performance of Radiotelephone Links.—C. Ducot. (*Onde élect.*, Jan. 1955, Vol. 35, No. 334, pp. 41–54.) C.C.I.F. recommendations on multiplex links are examined with particular reference to thermal and intermodulation noise. Experimental results are presented for a 48-channel link of length 12·5 km using a double f.m. system with a carrier frequency of 3·5 kMc/s and a final frequency deviation of ± 5 Mc/s; high output power is obtained using the multireflection oscillator valve described by Coeterier (2628 of 1947). The performance of double and simple f.m. systems is compared.

621.319.339 **2077**

The Calculation of Voltage Surges in a Van de Graaff Generator.—B. Millar. (*Brit. J. appl. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 13–15.)

621.365.54 : 621.385.002.2 **2078**

High-Frequency Induction Heating.—(*Metal Ind., Lond.*, 21st Jan. 1955, Vol. 86, No. 3, p. 52.) Application of the h.f. heating process to the brazing of thermionic-valve components is described briefly. The parts are placed in an atmosphere of forming gas during the process. A 25-kW generator operating at a frequency of 2 Mc/s is used.

621.365.65 **2079**

A New Application of Dielectric Heating.—A. Blake. (*Plastics*, Jan. 1955, Vol. 20, No. 210, pp. 31–32.) The use of dielectric heating in the manufacture of rollers for leather tanning, printing, etc. is discussed. The method of mould manufacture is described.

621.373.4 : 621.365.55 **2080**

The Operation and Loading Characteristics of Valve Oscillators for Dielectric Heating.—V. L. Atkins. (*Electronic Engng*, March & April 1955, Vol. 27, Nos. 325 & 326, pp. 106–111 & 164–169.)

621.384.611 : 621.372.413 **2081**

Microtron Resonators.—H. F. Kaiser. (*J. Franklin Inst.*, Jan. 1955, Vol. 259, No. 1, pp. 25–46.) Q, shunt resistance and optimum size are discussed for various simple resonator shapes for use with the microtron (electron cyclotron). The design of confocal ellipsoidal-hyperboloidal resonators is considered, and an equation given relating resonator dimensions and operating frequency which has proved satisfactory for practical use.

621.384.612 **2082**

Synchrotron Oscillations induced by Radiation Fluctuations.—M. Sands. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 470–473.)

621.385.83 : 537.533 **2083**

The Influence of the Space Charge in an Electron Beam accelerated in a Constant Electrostatic Field up to Energies of Several MeV.—M. Sangster. (*Appl. sci. Res.*, 1955, Vol. B4, No. 4, pp. 261–270.) The development of an electron gun to give high-intensity current pulses is discussed. Calculation shows that, at an average field strength of 10^6 V/m in the acceleration tube, space charge begins to play a dominating part at a current density of 2 A/cm^2. Advantages are gained by making the first electrodes of larger diameter than the succeeding ones.

621.387.424 **2084**

Gas Discharge Mechanism of Halogen-Quenched Counters.—D. van Zoonen. (*Appl. sci. Res.*, 1955, Vol. B4, No. 4, pp. 237–248.)

621.387.424 **2085**

Corona Threshold and the Range of Velocities of Pulse Spread in Geiger Counters.—L. B. Loeb. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 275–277.)

629.113.06 : 621.383.27 **2086**

Scanning Disk improves Auto Headlight Dimmer.—J. Rabinow. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 170–173.) Description of an automatic arrangement capable of detecting headlights at 1 500 ft and tail lights at 300 ft; by interposing a motor-driven scanning disk in front of the multiplier photocell the dimming control action is made independent of the general illumination level.

681.81 : 621.37/.38 **2087**

Some Recent Developments in American Electronic Musical Instruments.—A. Douglas. (*Electronic Engng*, April 1955, Vol. 27, No. 326, pp. 154–159.) An account of developments in the direction of improved tonal synthesis and increased flexibility of control.

PROPAGATION OF WAVES

621.396.11 **2088**

On the Radio Wave Propagation in a Stratified Atmosphere.—R. Yamada. (*J. phys. Soc. Japan*, Jan. 1955, Vol. 10, No. 1, pp. 71–77.) Analysis is presented for propagation in a single-surface duct, the refractive-index profile being given by the expression $a + bh + ch^2$.

621.396.11 : 550.510.535 : 523.5 **2089**

Continuous Radar Echoes from Meteor Ionization Trails.—Eshleman, Gallagher & Peterson. (See 1985.)

621.396.11.029.55 : 523.5 **2090**

Observations of Distant Meteor-Trail Echoes followed by Ground Scatter.—W. L. Hartsfield. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 53–56.) "Observations of backscatter on 13·7 Mc/s over a southeasterly path from Sterling, Virginia, revealed the existence of meteor-trail reflections just ahead of the main body of the backscatter, demonstrating that the latter was from the ground in these instances. The existence of apparent two-hop backscatter without the appearance of one-hop was noted in a number of cases. Possible reasons for this behavior are discussed."

621.396.11.029.55 : 621.396.824 **2091**

Some Considerations on the Measurement of Bearing of the Incoming Short Waves: Part 1.—I. Kasuya. (*J. Radio Res. Labs Japan*, June 1954, Vol. 1, No. 5, pp. 29–40.) During undisturbed ionospheric conditions in early February 1954 measurements were made with c.r.d.f. equipment and U-Adcock aerials of the variations in the bearing of standard-frequency 4-Mc/s A0 signals at four stations distant between 340 and 920 km from the transmitter. Results are compared with m.u.f. data for E and F regions. Difficulties of d.f. in the skip zone are noted. Twilight effect in lateral deviation δ was observed on a short-distance N-S path. A sudden 20-db increase in signal strength at Akita in the evening coincided with a sudden increase in δ at Sendai, distant about 170 km SSE.

621.396.11.029.62 : 551.594.5 **2092**

More about V.H.F. Auroral Propagation.—Dyce. (See 1987.)

621.396.11.029.62 : 621.317.328 **2093**

Measurements of Field Intensity of V.H.F. Radio Waves behind Mt. Fuji.—T. Kono, Y. Uesugi, M. Hirai, S. Niwa & H. Irie. (*J. Radio Res. Labs, Japan*, June 1954, Vol. 1, No. 5, pp. 1–15.) The 'diffraction gain of a mountain' (obstacle gain), defined as the ratio of the actual field-strength to that calculated for a smooth spherical earth, was investigated in May 1954 using f.m. and frequency-shift transmissions at 159·49 Mc/s with horizontal polarization. Receivers were located at distances up to 200 km behind Mt. Fuji, which is 3 780 m high and effectively 80 km from the transmitter. At Ise Bay, 180 km from Mt. Fuji, the maximum gain was about 85 db. Fading was generally slight. Path profiles and field-strength records are shown.

621.396.81.029.6 **2094**

V.H.F. and U.H.F. Reception: Effects of Trees and Other Obstacles.—J. A. Saxton & J. A. Lane. (*Wireless World*, May 1955, Vol. 61, No. 5, pp. 229–232.)

621.317.373 : 621.317.755 **2061**

A Direct Method of Phase Measurement on the Cathode-Ray Tube.—D. Karo. (*Brit J. appl. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 10–12.)

621.317.42 **2062**

New Method for Measurement of Magnetic-Field Distribution.—U. Dolega, H. Pfeifer & A. Lösche. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 12–13.) A nuclear-resonance method is described. A twin-coil system is used to ease the requirement for high time constancy of the field under examination.

621.317.42 **2063**

The Förster Probe for Measurement of Strong Magnetic Fields.—F. Brandstaetter. (*Elektrotech. u. Maschinenb.*, 1st Jan. 1955, Vol. 72, No. 1, pp. 12–15.) A l.f. differential method suitable for measurements up to 4 000 oersted is described. The probe comprises two parallel carbonyl-iron cores each carrying a primary and a secondary; the primaries are wound to produce magnetization in the same sense, the secondaries are wound in opposition. In use, one of the cores is in the field, the other is outside it. Using the ancillary oscillator (~ 10 kc/s) and amplifier circuits described, direct indication of the field strength can be obtained.

621.317.7 : 621.383 **2064**

On the Theory of Photoelectric Compensators and their Accuracy.—A. Kelen. (*Appl. sci. Res.*, 1955, Vol. B4, No. 4, pp. 278–284.)

621.317.7 : 621.383 **2065**

A Photoelectric Compensator with Good Zero Stability.—A. Kelen. (*Appl. sci. Res.*, 1955, Vol. B4, No. 4, pp. 285–288.)

621.317.725 **2066**

An Inverted-Triode Voltmeter for the Measurement of Negative Voltages.—R. Génin. (*J. Phys. Radium*, Jan. 1955, Vol. 16, No. 1, pp. 74–75.)

621.317.729 **2067**

The Rubber Membrane and the Solution of Laplace's Equation.—W. Fulop. (*Brit. J. appl. Phys.*, Jan. 1955, Vol. 6, No. 1, pp. 21–23.) Examination of the theory of the rubber membrane, as used, e.g. for investigating e.s. fields, indicates that Laplace's equation holds without restriction.

621.317.755 **2068**

Measurement of Time Constants with the Cathode-Ray Oscillograph.—R. Guillien & H. Mayer. (*C. R. Acad. Sci., Paris*, 14th Feb. 1955, Vol. 240, No. 7, pp. 739–741.) A method described by Tolstoi & Feofilov is discussed. A voltage with a known adjustable time constant is applied to the c.r.o. X plates; the trace, which is in general a transcendental curve, becomes a straight line when the time constant of the unknown voltage applied to the Y plates becomes equal to that of the X-plate voltage. Circuit methods for improving the attainable accuracy are considered, and an outline is given of a suitable arrangement.

621.317.761 **2069**

High Precision Automatic Frequency Comparator and Recorder.—J. M. Shaull. (*Tele-Tech & Electronic Ind.*, Jan 1955, Vol. 14, No. 1, Section 1, pp. 58–59 . . 134.) Description of apparatus in use at the N.B.S. enabling frequency differences of the order of 1 part in 10^{11} to be detected and recorded. The improvement in sensitivity as compared with apparatus and methods described previously (1731 of 1953) is obtained by use of an auxiliary cavity-type multiplier-converter unit, permitting comparison at about 1 kMc/s instead of 100 Mc/s.

621.385.001.4 **2070**

Quality Screening for Audio-Frequency Impulse Noise and Microphonism.—R. J. Wohl & S. Winkler. (*Elect. Engng, N.Y.*, Jan. 1955, Vol. 74, No. 1, Section 1, pp. 54–56.) Test gear described includes a pendulum tapper for exciting valves to produce a.f. noise, and indicating circuits using biased thyratrons to operate neon lamps. Procedure adopted for trials on 100 unselected valves is described. Unsatisfactory valves are eliminated with greater facility than by use of procedures based on a statistical approach. See also *Proc. nat. Electronics Conf., Chicago*, 1953, Vol. 9, pp. 119–129 (Wohl et al.).

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.77 : [621.387 : 621.318.57 **2071**

A High-Speed Revolution Counter.—E. L. Harrington. (*Electronic Engng*, April 1955, Vol. 27, No. 326, pp. 142–146.) An instrument designed for measuring the rotational speed of gas turbines to within ± 1 rev/min at 20 000 rev/min operates by counting a frequency proportional to speed over a 1-sec sampling period, at sampling intervals of 3 sec. The counter uses dekatrons.

534.143 : 529.78 : 621.314.7 **2072**

Electronic Clock using Transistors.—N. Boyer. (*Électronique, Paris*, Jan. 1955, No. 98, pp. 20–22.) A self-maintained-pendulum precision clock is described in which the electrical maintaining mechanism operates without contacts, using instead a transistor as a relay. The only power supply required is a 1·5-V cell. Other possible applications relating to the maintenance of mechanical oscillations are indicated briefly.

616.006.4 : 534.2-8 **2073**

Ultrasonic Ranging speeds Cancer Diagnosis.—J. J. Wild & J. M. Reid. (*Electronics*, March 1955, Vol. 28, No. 3, pp. 174–180.)

621-52 + 681.142 **2074**

I.V.A. [Royal Swedish Academy of Engineering Sciences] **Director's Annual Report on Progress in Research and Technology: Part 4—Computers and Automation.**—Velander. (See 1878.)

621.316.71 **2075**

The Automatic Factory—a Critical Examination.—S. A. June, J. D. Bardis, L. H. Lurio, L. S. Polaner, O. Sagedahl, H. A. Sklenar & B. K. Yenkin. (*Instruments & Automation*, Dec. 1954, Vol. 27, No. 12, Part 1, pp. 1952–1957; Jan. & Feb. 1955, Vol. 28, Nos. 1 & 2, pp. 110–114 & 277–279.) Automatic processes used in industry have been analysed. Apart from cost, the main obstacle to fully automatic operation is the difficulty in assembly of parts.

621.317.39.082 : 621.38 **2076**

Electronic Indicators of Mechanical Quantities.—L. A. Goncharski. (*Uspekhi fiz. Nauk*, Jan. 1955, Vol. 55, No. 1, pp. 81–100.) A review is presented of the author's work on measurement of small displacements (827 of March) and of work published in other countries on accelerometers, tensometers, manometers, etc. 17 references.

519.2 : 530.16 **2048**

Distribution of the Extreme Values of the Sum of n Sine Waves phased at Random.—S. O. Rice. (*Quart. appl. Math.*, Jan. 1955, Vol. 12, No. 4, pp. 375–381.)

519.24 **2049**

Practical Analysis of Sequences of Observations or Empirical Functions.—O. M. J. Mittmann. (*Arch. Met. A, Wien*, 7th Jan. 1955, Vol. 8, Nos. 1/2, pp. 113–120.) A method is described for finding the variance of the average of any empirical sequence of numbers, based on the assumption that as the sequence tends to infinity the standard deviation tends to zero.

MEASUREMENTS AND TEST GEAR

621.314.7.001.4 **2050**

A Point-Contact Transistor Test Set.—R. S. Hill. (*Elect. Engng, N.Y.*, Jan. 1955, Vol. 74. No. 1, Section 1, pp. 59–62.) Detailed operating instructions are presented relative to the tests described by Wooley (1092 of April).

621.317 **2051**

Precision Electrical Measurements.—L. Hartshorn. (*Nature, Lond.*, 8th Jan. 1955, Vol. 175, No. 4445, pp. 57–58.) Report of symposium held at the National Physical Laboratory in November 1954.

621.317.3 : 621.315.212 : 621.397.5 **2052**

Evaluation of Pulse-Reflection Curves for determining the Length and True Magnitude of Inhomogeneities in Wide-Band Cables.—L. Krügel, (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 14–18.) A 'd.c.' and an 'a.c.' pulse were used; the former approximated a one-quarter-cycle sinusoidal voltage of duration 4×10^{-8} sec between zero and maximum, the latter a similar pulse but of duration $1{\cdot}8 \times 10^{-8}$ sec. Examples of typical waveforms of pulses reflected at faults of various lengths at distances up to about 3 km from the instrument are discussed.

621.317.3 + 621.396.621] : 621.396.822 **2053**

On Power Spectra and the Minimum Detectable Signal in Measurement Systems.—J. J. Freeman. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 236–240.) A least upper bound for the minimum detectable value of a signal received in noise is specified in terms of the first and second moments of the rectified output. The power spectrum of the rectified output and the impedance characteristic of the output meter together enable the first and second moments of the meter deflection to be determined in two specified modes of operation.

621.317.328(083.74) **2054**

Study of the Very-High-Frequency Field-Intensity Standard.—T. Yagara & G. Kondo. (*J. Radio Res. Labs, Japan*, June 1954, Vol. 1, No. 5, pp. 63–71.) The use of a crystal voltmeter in the standard-aerial method of field-strength measurement is discussed and experimental results obtained at different frequencies by this method and the standard-field method are compared. The former is preferred. Replacing the crystal voltmeter by a vacuum thermocouple gave similar results at 55 Mc/s. See also 3090 of 1950 (Greene & Solow) and 154 of 1951 (King).

621.317.33.029.6 **2055**

Techniques for the Measurement of Impedances at Metre and Decimetre Wavelengths and their Use for studying the Dielectric Properties of Solids and Liquids.—A. Lebrun. (*Ann. Phys., Paris*, Jan./Feb. 1955, Vol. 10, pp. 16–70.) A comprehensive account is given of resonance methods involving variation of the length of a section of transmission line. Compared with cavity-resonator methods, these have the advantage of covering a wide frequency band with a single apparatus. Results obtained with some normal saturated alcohols are reported. 74 references.

621.317.335.029.62/.63 **2056**

Measurements of Materials at Ultrahigh Frequencies.—H. Schwan & K. Li. (*Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1954, Vol. 73, pp. 603–607. Digest, *Elect. Engng, N.Y.*, Jan. 1955, Vol. 74, No. 1, Section 1, p. 64.) Discussion of methods involving measurements of standing waves resulting from reflection of energy from a dielectric sample indicates that small sample thickness and open-circuit techniques are desirable for determining the dielectric properties of high-permittivity materials over the frequency range 100–1 000 Mc/s.

621.317.335.3 : 621.372.8 **2057**

Methods of Measuring Dielectric Constants based upon a Microwave Network Viewpoint.—A. A. Oliner & H. M. Altschuler. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 214–219.) Measurement procedures are discussed in which the dielectric sample is located within a waveguide; the admittance determinant of the quadripole system thus constituted is simply related to the required dielectric constant.

621.317.337 : 621.372.412 **2058**

Application of Frequency Modulation to the Determination of the Quality Factor Q of Piezoelectric Crystals.—H. Mayer. (*C. R. Acad. Sci., Paris*, 7th Feb. 1955, Vol. 240, No. 6, pp. 612–614.) The signal from a frequency-shift oscillator is applied in push-pull across a potentiometer, while the voltage from the oscillating crystal is superposed at one terminal only of the potentiometer. A tapping on the potentiometer is adjusted so that the output comprises only the voltage due to the crystal; this is amplified, detected and applied to a c.r.o. The crystal may be in the form of a few grains vacuum-sealed between the plates of a capacitor. A formula is presented by means of which the Q of the crystal can be calculated from the photographed oscillogram.

621.317.361 : 621.317.755 **2059**

A Method for Accurate Determination of Frequency.—L. Horn. (*Frequenz*, Oct. 1954, Vol. 8, No. 10, pp. 304–306.) The c.r.o. timebase frequency is derived from the mains, and the signal of unknown frequency, up to 2 Mc/s, is passed through a pulse former and a counter circuit. When the unknown frequency is a multiple or certain fraction of the timebase frequency, a stationary stepped pattern is obtained. With a slight adjustment in experimental arrangement phase can also be measured.

621.317.361 : 621.396.822 **2060**

Short-Time Frequency Measurement of Narrow-Band Random Signals by Means of a Zero Counting Process.—H. Steinberg, P. M. Schultheiss, C. A. Wogrin & F. Zweig. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 195–201.) Further consideration of the problem of determining the true frequency of a signal represented by a power spectrum, when measured over a finite time interval [206 of January (Schultheiss et al.)]. A third method now discussed consists of counting the zeros of the signal in the specified interval. For a Gaussian power spectrum the figure of merit of the arrangement used, defined by output-variance/sensitivity-squared [2168 of 1945 (Rice)], is comparable with those of the autocorrelator and frequency discriminator.

ballistically are shown for Ni-Co alloy specimens containing between 0·6% and 99·86% Co. γ-phase alloys containing $> 25\%$ Co show hysteresis loops of the constricted form similar to those of annealed perminvars and permalloys. The characteristic may be explained by the stabilization of domain walls due to the appearance of an additional uniaxial anisotropy along the directions of magnetization vectors during annealing. Results are presented graphically and references to earlier work on other physical properties of Ni-Co alloys are given.

538.221 : 621.317.411.029.64 **2035**

Measurement of the Complex Permeability of Carbonyl Iron Powders at 4 000 Mc/s.—A. Nishioka & H. Okamoto. (*J. phys. Soc. Japan*, Jan. 1955, Vol. 10, No. 1, p. 79.) Measurements are reported on four samples with different particle sizes, the powders being dispersed in polystyrol. The variation with particle size is discussed briefly in relation to skin effect.

538.221 : 621.318.134 **2036**

Magnetic Rotation Phenomena in a Polycrystalline Ferrite.—D. Park. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 60–66.) The h.f. properties of polycrystalline ferrites are analysed, taking account of the interaction between neighbouring crystallites. Expressions derived for the susceptibility lead to values in satisfactory agreement with those obtained experimentally by Brown & Gravel (2037 below).

538.221 : 621.318.134 **2037**

Domain Rotation in Nickel Ferrite.—F. Brown & C. L. Gravel. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 55–59.) Permeability measurements were made on specimens prepared by sintering, at various temperatures, ferrite particles of dimensions between 0·5 and $1\,\mu$. The results indicate that for such specimens the initial permeability and the r.f. dispersion are due principally to rotation of the crystallite magnetic moments in an equivalent anisotropy field.

538.221 : 621.318.134 **2038**

The *g*-Factor of Ferromagnetic Spinels.—Y. Kojima. (*Sci. Rep. Res. Inst. Tohoku Univ., Ser. A*, Dec. 1954, Vol. 6, No. 6, pp. 614–622.) An experimental investigation is reported of ferromagnetic resonance in Ni-Zn and Mn-Zn binary ferrites and Ni ferrite aluminates of various compositions, at frequencies of about 9·4, 19·2 and 28·9 kMc/s. The observed variation of the *g*-factor with composition is in good agreement with theoretical results, except in $NiFe_{2-x}\,Al_x\,O_4$ at $x > 0{\cdot}72$. The frequency dependence of the *g*-factor is mainly determined by the porosity of the specimen. Results are presented graphically.

538.221 : 621.318.134 **2039**

Ferromagnetic Resonance in Nickel Ferrite between One and Two Kilomegacycles [per second].—H. Suhl. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 555–557.) Resonance in the band considered is obtained by a special experimental arrangement producing a particularly low effective field. Some results are presented.

538.652 : 538.221 **2040**

The Magnetostriction Constants of Silicon Steel: Part 2.—H. Takaki & Y. Nakamura. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 748–752.) Part 1: 785 of March. Further measurements show that the magnetostriction constant λ_{100}, after decreasing nonlinearly as the Si content is increased up to 2%, rises sharply at Si values between 2% and 3%, and then shows little change up to 4% Si.

621.315.616 **2041**

Dielectric Constants and Mechanical Losses of High Polymers.—H. Thurn. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 44–47.) Small discontinuities are observed in the dielectric-constant/temperature characteristic for strongly and for weakly polar high polymers; the temperature points at which the discontinuities occur depend on frequency. For a given frequency, the ultrasonic-absorption/temperature characteristic exhibits a maximum and the ultrasonic-velocity/temperature characteristic slopes steeply at the same points. The cause of the discontinuities is thought to be variation of the freedom of motion of weakly polar partial groups.

621.318.122 **2042**

The Magnetic Properties and their Temperature Dependence of Ferromagnetic Alloys with an Order-Disorder Transformation.—T. Taoka & T. Ohtsuka. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 712–729.) Measurements made on samples at different fixed degrees of order, and particularly in the transformation temperature range, are reported and discussed. In Ni_3Fe the Curie point, saturation magnetization and magnetostriction all increase with the formation of the superlattice. In Ni_3Mn the Curie point increases from below room temperature in the disordered state to over 490°C in the ordered state; saturation magnetostriction is very small; large long-period magnetic after-effects occur at intermediate states of order.

621.318.2.042.15 **2043**

Influence of Additives in the Production of High Coercivity Ultra-Fine Iron Powder.—E. W. Stewart, G. P. Conard II & J. F. Libsch. (*J. Metals, N.Y.*, Jan. 1955, Vol. 7, No. 1, Section 2, pp. 152–157.) Magnesium formate, cadmium formate, cadmium oxide, stannous oxide or tin formate, when added in the correct proportion to ferrous formate prior to its reduction, inhibit sintering and markedly improve the magnetic properties of the compacts produced from the resulting powders.

669.871.4 **2044**

Purification of Gallium by Zone-Refining.—D. P. Detwiler & W. M. Fox. (*J. Metals, N.Y.*, Jan. 1955, Vol. 7, No. 1, Section 2, p. 205.) The method involves cleaning the surface by acid leaching, followed by zone refining to remove metallic impurities.

53 **2045**

Dielectrics and Waves. [Book Review]—A. R. von Hippel. Publishers: Chapman & Hall, London, 284 pp., 128s. (*Wireless Engr*, May 1955, Vol. 32, No. 5, p. 143.) A treatment in which the physics and electrical engineering aspects are combined.

537.311.33 + 621.314.7 **2046**

Halbleiter-Probleme: Vol. I. [Book Review]—W. Schottky (Ed.). Publishers: F. Vieweg & Sohn, Brunswick, W. Germany, 1954, 387 pp., DM 28.80. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, p. 62.) A collection of papers presented at the semiconductor conference of the German Physical Societies at Innsbruck in autumn 1953.

MATHEMATICS

517.948 **2047**

The Solution by Iteration of Nonlinear Integral Equations.—M. Lotkin. (*J. Math. Phys.*, Jan. 1955, Vol. 33, No. 4, pp. 346–355.)

as modified by Prince (1462 of 1954), in that the diffusion perpendicular to rather than along the direction of the drift is determined. Surface effects are thus completely eliminated. The hole mobility and the temperature dependence of the diffusion constant of holes are in agreement with those found by Prince; for electrons the values obtained are appreciably different.

537.311.33 : 546.289 **2021**

Galvano-magnetic Effects in Germanium at High Frequencies.—B. Donovan & G. Reichenbaum. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 993–995.) A brief report is presented on experimental determinations of the relative change of resistivity in a magnetic field and the Hall coefficient for a selection of Ge samples. Frequencies up to 3 Mc/s were used; in all cases the results were found to be independent of frequency.

537.311.33 : 546.289 : 538.214 **2022**

Magnetic Susceptibility Measurements on Germanium between Room Temperature and Liquid Hydrogen Temperatures.—A. van Itterbeek, L. de Greve & W. Duchateau. (*Appl. sci. Res.*, 1955, Vol. B4, No. 4, pp. 300–308.) Results obtained are compared with those of Stevens & Crawford (1467 of 1954); a large measure of agreement is found. At liquid-hydrogen temperatures there is a marked variation of the susceptibility associated with the paramagnetic term for the ionized impurity [1476 of 1954 (Busch & Mooser)].

537.311.33 : 546.289 : 621.314.632 **2023**

Properties of Metal to Germanium Contacts.—C. V. Bocciarelli. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 1020–1025.) A discussion is presented of the electrical properties of plates and evaporated contacts; repeatable characteristics are obtainable.

537.311.33 : 546.431-31 **2024**

Structure in Optical Absorption of Barium Oxide Films.—R. J. Zollweg. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 288–290.) "Measurements of the optical absorption of BaO films at temperatures between 15°K and 370°K are reported. Four absorption peaks between 3·8 eV and 4·5 eV are found for measurements at liquid nitrogen temperature or below."

537.311.33 : 546.482.21 **2025**

Controlled Preparation and X-Ray Investigation of Cadmium Sulfide.—F. Schossberger. (*J. electrochem. Soc.*, Jan. 1955, Vol. 102, No. 1, pp. 22–26.)

537.311.33 : 546.482.21 : 535.215 **2026**

Photoelectric Properties of Evaporated CdS Films.—W. Veith. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 1–7.) Films with high photoconductivity can be obtained by evaporation; Cu and Ag are used as sensitizers. Experiments are described which enable the structure of the film and the photoconduction mechanism to be understood.

537.311.33 : [546.817.221 + 546.817.231 + 546.817.241
2027

The Hall Coefficient, Electrical Conductivity and Magneto-Resistance Effect of Lead Sulphide, Selenide and Telluride.—E. H. Putley. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 22–34.) Procedure and results are described for measurements of Hall coefficient and conductivity of single crystals and natural specimens of PbS, PbSe and PbTe over the temperature range 77°–1 000°K; some measurements at 20°K are also described. The magnetoresistance effect was measured on some specimens at temperatures between 20° and 300°K. The results are consistent with accepted semiconductor theory. See also 2028 below.

537.311.33 : [546.817.231 + 546.817.241 **2028**

Thermoelectric and Galvanomagnetic Effects in Lead Selenide and Telluride.—E. H. Putley. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 35–42.) Measurements of the thermoelectric power and of the Peltier, Nernst, Ettinghausen and Righi-Leduc effects are reported. The results are in accordance with accepted semiconductor theory. Values of the coefficients calculated from the Hall coefficient and conductivity of the specimen are in good agreement with the measured coefficients. The effective mass of carriers in PbSe is estimated. See also 2027 above.

537.311.33 : 546.817.231 **2029**

Hall Effect and Electrical Conductivity of Lead Selenide.—E. Hirahara & M. Murakami. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 671–681.) Measurements in the temperature range from 500°C to − 180°C are reported. Results for *p*-type specimens are analysed taking account of scattering from both lattice and impurity centres and of the temperature dependence of Fermi energy. Errors of approximation in calculating Fermi energies of impurity semiconductors with both *p*- and *n*- type conduction are discussed.

537.311.33 : 548.0 : 535.34 **2030**

Infrared Lattice Absorption in Ionic and Homopolar Crystals.—M. Lax & E. Burstein. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 39–52.) Evidence is discussed relevant to the possibility that appreciable deformation of the charge distribution about the atoms results from lattice vibration. This deformation introduces a second-order electric moment, whose effect on the infrared absorption is analysed. In the case of diamond, Si and Ge, part of the absorption is due to this effect, the remainder being due to impurity-induced first-order electric moments. The second-order effect also affords an explanation of the side bands in the absorption and reflection spectra of the alkali halides, but not of the observed broadening of the main absorption line.

538.221 **2031**

Neutron Diffraction Studies of the Magnetic Structure of Alloys of Transition Elements.—C. G. Shull & M. K. Wilkinson. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 304–310.) Data on scattering and magnetic moments are presented for members of the alloy series Fe-Cr, Ni-Fe, Co-Cr and Ni-Mn.

538.221 **2032**

Theory of the Faraday and Kerr Effects in Ferromagnetics.—P. N. Argyres. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 334–345.) A treatment based on the energy-band theory of metals is presented.

538.221 **2033**

Relation between the Temperature of a Ferromagnetic Body and the Heat dissipated in its Interior by an Alternating Field.—G. Ribaud & D. Bordier. (*C. R. Acad. Sci., Paris*, 14th Feb. 1955, Vol. 240, No. 7, pp. 703–707.) From measurements on hollow Ni and Fe cylinders heated by an internal resistor and located inside a h.f. coil, curves are derived showing the power dissipated as a function of temperature. The curve rises from room temperature to Curie temperature, when it drops sharply to a low value corresponding to a nonmagnetic metal. The effect is attributed to an increase of initial permeability with temperature.

538.221 **2034**

Magnetic Hysteresis in Annealed Nickel-Cobalt Alloys.—M. Yamamoto, S. Taniguchi & K. Hoshi. (*Sci. Rep. Res. Inst. Tohoku Univ., Ser. A*, Dec. 1954, Vol. 6, No. 6, pp. 539–550.) Hysteresis curves determined

537.311.33 : [546.28 + 546.289 **2009**

Ground State of Impurity Atoms in Semiconductors having Anisotropic Energy Surfaces.—M. A. Lampert. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 352–353.) An approximate calculation is made of the binding energy of the impurity ground state using experimentally determined values of effective electron mass; the energy contours are assumed to be symmetrically located ellipsoids. Theoretical and experimental results are compared with conduction-band electrons and donor impurities in Ge and Si.

537.311.33 : [546.28 + 546.289 **2010**

Plastic Deformation of Germanium and Silicon by Torsion.—E. S. Greiner. (*J. Metals, N.Y.*, Jan. 1955, Vol. 7, No. 1, Section 2, pp. 203–205.)

537.311.33 : 546.28 **2011**

Ionization and Solubility in Semiconductors.—H. Reiss & C. S. Fuller. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 559–560.) Based on the theory of Reiss (*J. chem. Phys.*, 1953, Vol. 21, p. 1209) concerning the effects of hole-electron equilibrium on solubility, a formula is derived relating the concentration of donors in a semiconductor to the concentration of acceptors. Calculated and observed values are compared for B-doped Si saturated with Li.

537.311.33 : 546.28 **2012**

Effect of Crystal Distortion upon Change of Resistivity of Silicon by Heat Treatment.—W. C. Dash. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, p. 354.) Results of experiments suggest that structural imperfections of the crystal retard the appearance of *n*-type carriers in crystals heated at 450°C.

537.311.33 : 546.28 **2013**

Trapping of Minority Carriers in Silicon: Part 1—*P*-Type Silicon.—J. A. Hornbeck & J. R. Haynes. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 311–321.) Photoconductivity decay curves obtained after cutting off illumination demonstrate the existence of two sets of electron traps of different depths in *p*-type Si at room temperature. The traps are distributed within the body of the specimen rather than at the surface. An energy-level model is developed to fit the results. In low-resistivity specimens recombination of electrons from the deeper traps is proportional to the square of hole concentration. The deep trap concentration is roughly proportional to conductivity.

537.311.33 : [546.289 + 546.3-1-28-681 **2014**

Melting Point of Germanium and the Constitution of Some Ge-Ga Alloys.—E. S. Greiner & P. Breidt, Jr. (*J. Metals, N.Y.*, Jan. 1955, Vol. 7, No. 1, Section 2, pp. 187–188.)

537.311.33 : 546.289 **2015**

Measurements of Injection Ratio of Point Contacts on Germanium.—P. C. Banbury & J. Houghton. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 17–21.) Measurements were made on *n*-type specimens, using the method described by Shockley et al. (380 of 1950). Injection ratio γ was found to be insensitive to the nature of the contact material, to the contact thrust, and to the carrier concentration of the Ge over the limited range investigated. In all cases measured, γ decreased with increasing emitter current over the range 0·5 to 30 mA. A slight decrease of γ with increasing humidity of the ambient air was also observed.

537.311.33 : 546.289 **2016**

The Effective Surface Recombination of a Germanium Surface with a Floating Barrier.—A. R. Moore & W. M. Webster. (*Proc. Inst. Radio Engrs*, April 1955, Vol. 43, No. 4, pp. 427–435.) One-dimensional analysis is used to examine the possibility of reducing surface recombination velocity *s* by special surface treatments; three types considered are (*a*) electroplated metal layer, (*b*) Ge layer of opposite conductivity, and (*c*) Ge layer of higher conductivity of same type. Calculations indicate that *s* should be of the order of 1 cm/s for cases (*b*) and (*c*) and > 1 000 cm/s for case (*a*). Measurements of *s* on alloyed junction surfaces indicate that their apparent recombination velocity is nearly the same as that of the adjacent untreated surfaces, e.g. 300–500 cm/s. The discrepancy is attributed to lateral current flow due to gradients parallel to the interface, which are neglected in the one-dimensional theory. This effect is discussed in relation to erroneous values of carrier lifetime which have been obtained from diffusion measurements.

537.311.33 : 546.289 **2017**

Carrier Extraction in Germanium.—J. B. Arthur, W. Bardsley, M. A. C. S. Brown & A. F. Gibson. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 412B, pp. 43–50.) Extraction may be expected to occur in an *n*-type crystal when the sweeping voltage applied is of a magnitude such that the transit time of holes is very much shorter than the hole lifetime. A distinction is drawn between this effect and the depletion of minority carriers at a reverse-biased rectifying contact. Techniques are described in which large changes of carrier concentration are produced in near-intrinsic Ge by extraction; use of direct and of pulsed fields is considered. The effect may have important implications for the design of new semiconductor devices.

537.311.33 : 546.289 **2018**

The Electrical Properties of Germanium Semiconductors at Low Temperatures.—H. Fritzsche & K. Lark-Horovitz. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 834–844.) Low-temperature effects including an anomalous maximum in the Hall effect and a change in the slope of the log-resistivity/inverse-temperature curve were reinvestigated using single crystals of *n*- and *p*-type Ge with various carrier concentrations. The experimental set-up is described and results are presented graphically. The observations are consistent with a model which assumes conduction in two energy bands, one of which is the usual conduction or valence band, the other a band with a very small mobility. The sharp decrease of this mobility with decreasing impurity content suggests that the observed characteristics may be due to conduction in an impurity band.

537.311.33 : 546.289 **2019**

Recombination and Trapping of Carriers in Germanium.—H. Y. Fan, D. Navon & H. Gebbie. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 855–872.) Report of experiments at temperatures between liquid-nitrogen and room temperature. Consideration is mainly confined to *n*-type and *p*-type single crystals with no intentionally introduced lattice imperfections or impurities other than the commonly used impurities of the 3rd and 5th groups of elements. The results indicate that carrier lifetime decreases with reduction of temperature, but much faster in *n*-type than in *p*-type material. These results are discussed in terms of recombination through trapping states.

537.311.33 : 546.289 **2020**

Diffusion Constant of Carriers in Germanium.—A. Many. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 985–989.) Results are presented of determinations of the diffusion constant by measurement of injected-carrier lifetime in rectangular filaments with rough surfaces. The method used differs from that of Shockley & Haynes,

537.226 : 546.212 **1998**

Dielectric Properties of Water Adsorbed by Silica Gel at Cm λ.—J. Le Bot & S. Le Montagner. (*J. Phys. Radium*, Jan. 1955, Vol. 16, No. 1, pp. 79–80.) Results of experiments at 10·37 cm λ using the method previously developed (2067 of 1953) show that the formula relating the frequency of maximum Debye absorption to absolute temperature is also valid at cm λ. The mean activation energy of the adsorbed water is 12·5 kcal/mol.

537.227 **1999**

Aging of the Properties of Barium Titanate and related Ferroelectric Ceramics.—W. P. Mason. (*J. acoust. Soc. Amer.*, Jan. 1955, Vol. 27, No. 1, pp. 73–85.) Variations with time of the dielectric constant and other electrical and elastic properties of various titanates have been observed. At room temperature such variations may continue for over a year, but stabilization can be hastened by heating the material. The aging is due to a reduction in the effective polarization caused by a slow temperature-induced motion of the domain walls; this is borne out by calculations.

537.227 **2000**

Effect of Mechanical Pressure on Dielectric Properties of a Ferroelectric Ceramic.—E. V. Sinyakov & I. A. Izhak. (*C. R. Acad. Sci. U.R.S.S.*, 11th Jan. 1955, Vol. 100, No. 2, pp. 243–246. In Russian.) Experimental results show that as pressure increases (up to 600 kg/cm^2) the spontaneous polarization decreases and induced polarization remains constant; the fractional variation of permittivity with pressure is $-1{\cdot}7 \times 10^{-4}$ cm^2 kg^{-1} at room temperature and $-5{\cdot}4 \times 10^{-4}$ cm^2 kg^{-1} at the Curie point, determined at 1 Mc/s in a weak field, and $-3{\cdot}10 \times 10^{-4}$ and $-5{\cdot}8 \times 10^{-4}$ cm^2 kg^{-1}, respectively, at 50 c/s in a field of 700 V/cm. The Curie point rises $2{\cdot}8 \times 10^{-8}$ deg C per kg/cm^2 increase of pressure. Results are presented graphically.

537.227 : 546.431.824-31 : 535.343.2 **2001**

Optical Behaviours of Multi-domain Single Crystal of $BaTiO_3$ in Dependence on Temperature.—T. Horie, K. Kawabe & S. Sawada. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 823–825.) Report of measurements of the transmission and absorption characteristics of samples about 20μ thick in the temperature range from −120°C to + 150°C.

537.311.33 + 621.315.6 **2002**

Recombination Processes in Insulators and Semiconductors.—A. Rose. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 322–333.) The terminology used to describe recombination processes is studied, and variations are noted as between the terms used in connection with luminescence, photoconductivity and semiconductors. Most of the recombination occurs at discrete states in the forbidden energy zone, which may be ground states or shallow trapping states; the latter cause the observed decay time of free carrier concentrations to exceed the lifetime of a free carrier. To account for certain anomalous phenomena such as infrared quenching, the 'superlinear' photocurrent/illumination characteristic, and the enhancement of photoconductivity on addition of recombination centres, it may be necessary to assume the existence of more than one class of ground states. Energy-level models for various possible cases are examined.

537.311.33 **2003**

Amsterdam Conference [on] **Semiconductors.**—(*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 801–1140.) The text is given of 65 papers and brief reports presented at the conference. These include reviews of the experimental evidence of band structure in Ge and Si, the surface properties of semiconductors (mainly Ge), the chemical and electronic aspects of impurity centres in Ge and Si, the electrical and optical properties of the PbS group, ZnS, and a large number of intermetallic compounds. Results of new determinations of various constants, including resistivity, Hall constant and thermoelectric power, are also reported. Abstracts of some of the papers are given below.

537.311.33 **2004**

The Electronic and Optical Properties of the Lead Sulphide Group of Semiconductors.—R. A. Smith. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 910–929.) Experimental results are reviewed and an attempt is made to clarify their interpretation.

537.311.33 **2005**

Fluctuations in the Number of Charge Carriers in a Semiconductor.—R. E. Burgess. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 1007–1010.) The brief treatment presented takes into account only the influence of recombination via the donors or acceptors responsible for determining n and p, the number of electrons in the conduction band or holes in the valence band respectively. Thermodynamic and statistical approaches show that when n and p are large numbers their fluctuations have a Gaussian-type distribution.

537.311.33 **2006**

Complex Index of Refraction of Semiconducting Surfaces.—P. H. Miller, Jr, & J. R. Johnson. (*Physica*, Nov. 1954, Vol. 20, No. 11, pp. 1026–1028.) Simple formulae are given for (*a*) the reflectivity near the Brewster minimum in terms of the complex refractive index $n\,(1 + i\alpha)$, when $\alpha \ll 1$, (*b*) the reflectivity at the minimum and (*c*) the angle between the incident ray and the incident ray at the minimum. The effect of a thin surface layer is also considered. The experimental set-up consists of a modified spectrometer with fixed light source and detector, constant deviation being obtained by use of an aluminized mirror fixed at an angle to the semiconductor surface investigated. See also 1304 of 1953 (Pikus).

537.311.33 : [546.28 + 546.289 **2007**

Modulation of the Surface Conductance of Germanium and Silicon by External Electric Fields.—G. G. E. Low. (*Proc. phys. Soc.*, 1st Jan. 1955, Vol. 68, No. 421B, pp. 10–16.) Experiments similar to those reported by Shockley & Pearson for thin semiconductor films (*Phys. Rev.*, 15th July 1948, Vol. 74, No. 2, pp. 232–233) have been made on single-crystal specimens of n- and p-type Ge and on p-type Si. Voltage pulses applied capacitively to the specimen produce rapid variations of its conductance, with corresponding variations of the e.m.f. across it in the presence of a sweeping current; these variations are recorded oscillographically. The observed conductance changes and their time dependence provide information concerning the surface barrier and the relaxation phenomena associated with departures from electronic and ionic equilibrium.

537.311.33 : [546.28 + 546.289 **2008**

Measurement of Carrier Lifetimes in Germanium and Silicon.—D. T. Stevenson & R. J. Keyes. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 190–195.) A method is used in which the bar-shaped sample is illuminated by a pulse of light and the current decay curve is displayed on an oscilloscope. Analysis of the solution of the diffusion equation yields methods of measuring the bulk lifetime, the surface recombination velocity and the diffusion constant.

551.594.5:621.396.11.029.53/.62 **1986**

Interpretations of Radio Reflections from the Aurora.—H. G. Booker, C. W. Gartlein & B. Nichols. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 1–22.) Report and discussion of measurement made at Ithaca, N.Y. Pulse radar experiments at 104 Mc/s show that (*a*) reflections occur only during aurorae having ray structure; (*b*) the transmitted beam must be directed roughly normal to the rays; (*c*) echoes are complex. C.w. signals at various frequencies between 2·4 and 144 Mc/s showed a rate of fading roughly proportional to frequency, i.e. much higher than the fading rate for normal ionospheric conditions. Observations are interpreted as indicating that echoes are due to scattering from numerous auroral columns of ionization; fading is due to wind-like motion of these columns. Other interpretations are critically discussed. Reasons are given for the possible occurrence of auroral reflection at F-region as well as E-region levels.

551.594.5 : 621.396.11.029.62 **1987**

More about V.H.F. Auroral Propagation.—R. Dyce. (*QST*, Jan. 1955, Vol. 39, No. 1, pp. 11–15..118.) Radio amateur reports of auroral propagation at 144 Mc/s since 1951 indicate an extended communication range along E-W direction rather than N-S. Automatic recordings at 50 Mc/s show a predominance of auroral reflection around 6 p.m. and 2 a.m. EST, an unexplained dip in the diurnal curve at midnight, a marked seasonal trend, and a decrease in occurrences from 1952 to 1954. In c.w. and radar experiments at College, Alaska, in 1953, echoes came from far north of the auroral zone, with ranges above 400 km, and never from the south; reflections probably occurred at heights of 100 km; angles of elevation were low no matter where visible aurorae occurred.

550.38 **1988**

Variations of the Terrestrial Magnetic Field in Hungary. [Book Review]—G. Barta. Publishers: Akadémiai Kiadó, Budapest, 1954, 146 pp., Ft. 60. (*Acta tech. Acad. Sci. hungaricae*, 1955, Vol. 10, Nos. 3/4, pp. 508–512. In Russian, English, French and German.) The text of this survey is given in Hungarian, Russian and German.

LOCATION AND AIDS TO NAVIGATION

621.396.969.3 **1989**

Radar in Inland Traffic.—A. Esau & K. Brocks. (*Fernmeldetech. Z.*, Jan. 1955, Vol. 8, No. 1, pp. 1–7.) Report on a commercial British-made marine-radar equipment which was tested on inland waterways, roads and railways. The p.p.i. display proved to be useful in river navigation and in the control of a railway marshalling yard. While the horizontal beam-width (1·7° to half-power), wavelength (3·2 cm) and pulse repetition rate (1 000/sec) were satisfactory, modifications are required to reduce the pulse duration ($\sim 10^{-7}$ sec at present), vertical beam-width (23°) and the radiated pulse power (7 kW); the scanning rate requires to be increased.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **1990**

Theory of Vapour-Jet Vacuum Pump.—V. I. Skobelkin & N. I. Yushchenkova. (*Zh. tekh. Fiz.*, Oct. 1954, Vol. 24, No. 10, pp. 1879–1891. Correction, *ibid.*, Feb. 1955, Vol. 25, No. 2, p. 366.) The action of a supersonic-jet pump is considered in two stages: (*a*) determination of the structure of the vapour jet, and (*b*) investigation of the diffusion of gas in such a jet. Pumping speeds calculated from the formulae derived are in good agreement with experimental results.

535.37 **1991**

Motion of Conduction Electrons in Luminescent Crystals.—D. Curie. (*J. Phys. Radium*, Jan. 1955, Vol. 16, No. 1, pp. 77–78.) Note discussing phosphorescence mechanisms and their terminology and the proportion of ejected electrons with free path $> 10^{-6}$ cm.

535.37 **1992**

The Effect of Superposing a Small Alternating Excitation on the Steady Excitation of a Luminescent Material.—K. F. Stripp & R. H. Bube. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 251–252.)

535.37 **1993**

Optical Properties of Calcium Meta-antimoniate.—J. Janin & R. Bernard. (*C. R. Acad. Sci., Paris*, 7th Feb. 1955, Vol. 240, No. 6, pp. 614–615.) Properties of this phosphor activated with Pb or Mn are discussed; an inaccuracy in a previous paper (158 of 1954) is noted.

535.37 + 535.215] : 534-8 **1994**

Effect of Ultrasonic Radiation on the Conductivity and Fluorescence of ZnS and CdS Crystals.—L. Herforth & J. Krumbiegel. (*Naturwissenschaften*, Jan. 1955, Vol. 42, No. 2, p. 39.) Experiments indicate that exposure of the crystals to ultrasonic radiation produces a rapid reversible reduction of photoconductivity but has no effect on the luminescence intensity.

535.37 : 546.482.21 **1995**

Infrared Emission Band and Kinetics of Semiconductor Processes in CdS in the Region of Temperature Quenching of Luminescence.—V. A. Arkhangel'skaya. (*C. R. Acad. Sci. U.R.S.S.*, 11th Jan. 1955, Vol. 100, No. 2, pp. 233–235. In Russian.) Oscillograms are presented of the rise and decay of luminescence and conductivity at temperatures between about 20° and 200°C. The rise and decay times are of the order of a few milliseconds. Relaxation in the infrared (about 950 mμ) band is slower than that for the red luminescence.

535.37 : 621.317.373 **1996**

Measurements of Luminescence Decay Time on Excitation by Electrons.—W. Hanle & H. G. Jansen. (*Z. Naturf.*, Sept. 1954, Vol. 9a, No. 9, pp. 791–797.) Modifications are described for converting the method of Rohde (1504 of 1954) into an absolute method. Further measurements on organic phosphors indicate that decay time depends on grain size, degree of purity, and type of excitation.

537.224 **1997**

Naphthalene Electrets and the Origin of their Homocharge.—W. Baldus. (*Z. angew. Phys.*, Nov. 1954, Vol. 6, No. 11, pp. 481–489.) Experiments are reported on naphthalene, a nonpolar substance which exhibits the characteristic charge reversal and permanent electrification of electrets. This homocharge is conditioned by the electrode material and is suppressed if the sample is insulated by glass plates in the polarizing field. The internal field immediately after establishment of the homocharge is determined quantitatively, the change of sign being explained by the disappearance of a field component initially due to ordered and oriented dipoles. Space charge distribution within the electret is evaluated.

550.385 : 523.746 **1973**

Geomagnetic Activity and Sunspots.—P. Simon. (*C. R. Acad. Sci., Paris,* 28th Feb. 1955, Vol. 240, No. 9, pp. 940–942.) Analysis of observations by the method of superposed epochs shows that geomagnetic activity following the central meridional passage of certain sunspots is related more closely to their r.f. radiation than to their eruptive intensity.

550.385 : 523.755 **1974**

Correlation between the Solar Corona and the Geomagnetism for the Remarkable M-Regions in 1950–1953.—T. Shimazaki. (*J. Radio Res. Labs, Japan,* June 1954, Vol. 1, No. 5, pp. 51–61.)

551.510.52 : 621.396.11.029.62 **1975**

On the Distribution of Refractive Index in the Lower Atmosphere in Japan.—K. Tao & Y. Baba. (*J. Radio Res. Labs, Japan,* June 1954, Vol. 1, No. 5, pp. 17–28.) Radiosonde data for heights up to 3 km are analysed. Contour maps show the derived distribution of *k* (effective earth radius factor) for day and night in each month of the year; the *k* distribution is closely related to the movement of the air mass. Predicted values of field-strength for 150 Mc/s over a 125-km path are generally greater for summer than for winter, in agreement with observed values.

551.510.53 **1976**

Tidal Oscillations of the Lower Stratosphere.—D. H. Johnson. (*Quart. J. R. met. Soc.,* Jan. 1955, Vol. 81, No. 347, pp. 1–8.) Diurnal and semidiurnal variations of wind occurring in the lower stratosphere appear to be associated with solar tides. The semidiurnal variation in the stratosphere is in phase with and of comparable magnitude to the semidiurnal variation at the earth's surface. The diurnal variation in the stratosphere is of similar magnitude to the semidiurnal variation.

551.510.535 **1977**

Viscosity in the High Atmosphere.—D. G. Yerg. (*J. geophys. Res.,* March 1955, Vol. 60, No. 1, pp. 87–94.)

551.510.535 **1978**

Widespread Diurnal Variations of Effective Slope of the Ionosphere.—H. A. Whale. (*Nature, Lond.,* 8th Jan. 1955, Vol. 175, No. 4445, pp. 77–78.) Measurements have been made at Seagrove Radio Research Station, N.Z., of the bearing and elevation angles of signals received on 9·315 Mc/s from ZQD, Nandi, Fiji, distant 2 000 km almost magnetically north, and on 9·660 Mc/s from VLQ9, Brisbane, Queensland, distant 2 250 km almost magnetically west. From these measurements the effective slopes of the ionosphere are found to be related at places about 1 500 km apart and the average diurnal variation of these slopes is determined.

551.510.535 **1979**

Storms in the Ionosphere.—E. V. Appleton. (*Endeavour,* Jan. 1955, Vol. 14, No. 53, pp. 24–28.) A general survey of existing knowledge and theories of the world-wide disturbances in the upper structure of the ionosphere observed at times of magnetic storms. The effects on long-distance short-wave communication are briefly indicated.

551.510.535 **1980**

Behaviour of the Ionosphere at Rome during the Period 1948–1953.—P. Dominici. (*Ann. Geofis.,* Oct. 1954, Vol. 7, No. 4, pp. 503–520.) Ionosphere records obtained at Rome are analysed; the normal variations are established. Predicted values of f_0F_2 are shown graphically.

551.510.535 **1981**

Movement of the F-Region.—K. Toman. (*J. geophys. Res.,* March 1955, Vol. 60, No. 1, pp. 57–70.) Using three spaced receivers, continuous recordings were made in Massachusetts, during the period August 1952–December 1953 of a vertical-incidence and two oblique-incidence 3·5-Mc/s pulse transmissions, the base lines for the latter being 62 km and 109 km in directions roughly W-E and NW-SE. Horizontal speed and direction of winds in the F region were determined from the time displacement of echoes. At an average virtual height of 215 km average speed was 362 km/h and mean direction nearly parallel to the earth's magnetic field. Monthly averages of mean direction showed a semiannual period with maximum deviation E of N around the equinoxes. Monthly averages of speed, varying between 250 and 600 km/h, showed an annual period with higher values in winter than in summer. Speed increased with height.

551.510.535 **1982**

Intermediate Layers of Ionization between the E and F_1 Layers of the Ionosphere over Ahmedabad (23°N, 72·6°E).—R. G. Rastogi. (*Proc. Indian Acad. Sci.,* Section A, Oct. 1954, Vol. 40, No. 4, pp. 158–166.) Observations are reported indicating the regular occurrence of two intermediate layers with virtual heights of 125 km and 140 km respectively. Both layers exhibit magneto-ionic splitting. The variation of the critical frequencies with the sun's zenithal angle obeys a $\cos^n$ law, the value of n being about 0·38. True heights and thicknesses of the layers are determined for some cases; the values of true heights are in good agreement with rocket observations.

551.510.535 **1983**

Geomagnetic Control of the F_1 Region of the Ionosphere.—M. Ghosh. (*J. geophys. Res.,* March 1955, Vol. 60, No. 1, pp. 115–116.) Noon values of f_0F_1 and f_0F_2 for March, June and December of 1947 and 1951 plotted against geomagnetic latitude show the same type of geomagnetic control. The equatorial dip in the f_0F_1 curves is more pronounced in the year of higher sunspot activity. See also 2938 of 1954.

551.510.535 : 523.3 **1984**

A Measurement at Ottawa of the Change in Height with Lunar Time of the E Region of the Ionosphere.—C. A. Littlewood & J. H. Chapman. (*Canad. J. Phys.,* Jan. 1955, Vol. 33, No. 1, pp. 11–16.) "The method used by Appleton and Weekes to detect the lunar variation of height of the E region of the ionosphere has been used to determine the amplitude and phase of the lunar height variation at Ottawa. Observations were made from October to December, 1952. A sinusoidal variation of height of 1·5 km amplitude and 12 h period was observed. The maximum height occurred about six hours after lunar transit. This result differs in phase by six hours from that observed in Cambridge in 1938."

550.510.535 : 523.5 : 621.396.11 **1985**

Continuous Radar Echoes from Meteor Ionization Trails.—V. R. Eshleman, P. B. Gallagher & A. M. Peterson. (*Proc. Inst. Radio Engrs,* April 1955, Vol. 43, No. 4, p. 489.) Preliminary results are presented of experiments giving support to the view that meteoric ionization is the most important factor in extended-range v.h.f. propagation.

for the edge region, the functional form of the local fields can be determined without assuming a particular type of expansion. An indeterminacy present in the system of local integral equations can be removed when the local behaviour of certain field components is known in detail.

538.566 : 537.311.31 : 539.23 **1960**

Simultaneous Partial Absorption, Reflection and Transmission of a Uniform Plane Wave by a Thin Metal Layer.—M. Gourceaux. (*C. R. Acad. Sci., Paris*, 28th Feb. 1955, Vol. 240, No. 9, pp. 952–953.) Simple analysis is used to derive expressions for the energy reflected, transmitted and absorbed, for a normally incident wave. For given conductivity, the absorbed energy has a maximum value of half the incident energy at a particular value of thickness, the reflected and transmitted energies being then equal.

538.6 : 536.7 **1961**

Thermodynamical Theory of Galvanomagnetic and Thermomagnetic Phenomena.—R. Fieschi. (*Nuovo Cim.*, 1955, Vol. 1, *Supplement*, No. 1, pp. 1–47. In English.)

539.152.2 : 538.569.4 **1962**

Spin-Echo Memory Device.—S. Fernbach & W. G. Proctor. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 170–181.) "A proton-rich sample placed in a strong inhomogeneous magnetic field of mean strength H_0 was subjected to a pattern of relatively weak radio-frequency pulses at the Larmor frequency of the protons in the field H_0. The pattern was then recalled by applying a strong r.f. pulse at a later time as in the spin-echo technique. It is shown both mathematically and experimentally that such a series of pulses, varying in amplitude can be 'memorized' by the spin system of protons for times as long as one second and then repeated, preserving both shape and relative amplitude." Spin echoes are discussed by Hahn in *Phys. Rev.*, 15th Nov. 1950, Vol. 80, No. 4, pp. 580–594.

621.3.032.44 **1963**

The Distribution of Temperature along a Thin Rod Electrically Heated in Vacuo: Part 5—Time Lag.—S. C. Jain & K. S. Krishnan. (*Proc. roy. Soc. A*, 7th Jan. 1955, Vol. 227, No. 1169, pp. 141–154.) Expressions obtained previously (417 of February) for the steady-state temperature distribution are used to study the increase of temperature accompanying a small increase in heating current. Over a considerable region near the centre of the rod the temperature variation can be completely represented by a simple exponential law involving a single relaxation time, whose magnitude can be readily calculated. This method is compared with that based on the Fourier expansion; the latter can be adapted for general use by introducing an effective length to replace the actual length of the rod. For a given temperature at the centre the relaxation time varies inversely as the ratio of surface to volume, and is thus smaller for a ribbon filament than for one of circular cross-section, as observed by Prescott & Morrison (*Rev. sci. Instrum.*, 1939, Vol. 10, p. 36).

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523.16 **1964**

Radio Astronomy in Hawaii.—G. Reber. (*Nature, Lond.*, 8th Jan. 1955, Vol. 175, No. 4445, pp. 78–79.) Observations are being made of cosmic noise at frequencies near 20, 30, 50 and 100 Mc/s, using a Lloyd's-mirror technique. The interference patterns observed are discussed in relation to the nature of the sources and to ionospheric and solar variations.

523.16 : 523.72 **1965**

Interferometer Observations of Solar Radiation at 9 350 Mc/s.—I. Alon, J. Arsac & J. L. Steinberg. (*C. R. Acad. Sci., Paris*, 7th Feb. 1955, Vol. 240, No. 6, pp. 595–598.) The distribution of brightness over the solar disk has been studied by observations at Marcoussis subsequent to those reported previously (**3272** of **1953**). The sensitivity of the system was sufficient for reliable measurements of interference of magnitude down to 2·5%. The results confirm that (*a*) at this frequency the sun's apparent diameter is slightly greater than for the visible disk, and (*b*) limb brightening is present.

523.16 : 523.72 : 621.396.677.3 **1966**

New Array for Radio-Astronomical Observations of the Sun's Brightness at 9 350 Mc/s.—J. Arsac. (*C. R. Acad. Sci., Paris*, 28th Feb. 1955, Vol. 240, No. 9, pp. 942–945.) Equipment installed at Marcoussis comprises four identical parabolic mirrors of diameter 1·1 m located respectively at 0, *a*, 4*a* and 6*a* along an E-W line, where $a = 58\lambda$; the four aerials are connected to a single receiver by lines of equal length. The overall length of this array is 11·2 m, as compared with 15 m for a continuous mirror to give the same half-power lobe width. The arrangement enables the first six Fourier harmonics of the brightness distribution over the sun to be observed at true amplitude.

550.372 **1967**

The Apparent Specific Resistance of an Inclined Plane Stratum.—A. Huber. (*Arch. Met. A, Wien*, 7th Jan. 1955, Vol. 8, Nos. 1/2, pp. 95–112.)

550.38(47) **1968**

Fundamental Types of Geomagnetic Activity.—V. M. Mishin. (*C. R. Acad. Sci. U.R.S.S.*, 1st Jan. 1955, Vol. 100, No. 1, pp. 53–56. In Russian.) *K* indices obtained from observations at Irkutsk (geomagnetic latitude $\phi = 41°$), Watheroo ($\phi = -41°$), Slutsk ($\phi = 56°$) and Tashkent ($\phi = 32°$) are compared and discussed. The average *K* indices and *St*-variations for Irkutsk are presented graphically.

550.384 **1969**

Establishment of a New Process of Terrestrial Demagnetization—Period of the Latest Demagnetization-Remagnetization Cycles recorded for our Planet.—C. Gaibar-Puertes. (*Geofis. pura appl.*, Sept./Dec. 1954, Vol. 29, pp. 22–56. In Spanish.) Analysis of figures from observatories covering the whole world indicates oscillations in the intensity of the terrestrial magnetic field since 1885; an average period of 50 years is inferred for the remagnetization-demagnetization cycles.

550.385 **1970**

Solar Corpuscles responsible for Geomagnetic Disturbances.—J. C. Pecker & W. O. Roberts. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 33–44.) A qualitative hypothesis is presented.

550.385 **1971**

Annual Variation of the Magnetic Elements.—R. P. W. Lewis, D. H. McIntosh & R. A. Watson. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 71–74.)

550.385 **1972**

Note on the Occurrence of World-Wide S.S.C.'s during the Onset of Negative Bays at College, Alaska.—J. P. Heppner. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 29–32.) S.s.c.'s (sudden commencements followed by a period of storminess) may have an atmospheric source which is related to sudden changes in auroral activity.

with values ranging from zero to 90 eV and average values of 10 to 20 eV, depending on the applied field. The method is useful for determining the surface potential of the emitter.

537.56 : 538.566 **1949**

Experiments on the Behaviour of an Ionized Gas in a Magnetic Field.—W. H. Bostick & M. A. Levine. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 13–21.) Probe measurements in a plasma comprising electrons and helium ions in a toroidal tube with a toroidal magnetic field reveal an oscillatory current which is interpreted as indicating fluctuations of ion concentration consistent with magnetohydrodynamic waves of the type described by Alfvén (2777 of 1950). Microwave measurements on a toroidal cavity resonator indicate that the degree of diffusion control in helium at low pressure is very much less than expected from the classical theory of ambipolar diffusion of ions and electrons in a magnetic field. The diffusion-coefficient/magnetic-field curve passes through a minimum at about 600 G. Tentative explanations of the experimental results are advanced.

538.222 : 621.372.413 **1950**

Various Ways of using Cavity Resonators in Paramagnetic Resonance.—J. Uebersfeld. (*J. Phys. Radium*, Jan. 1955, Vol. 16, No. 1, pp. 78–79.) Note on operating conditions for greatest sensitivity in signal detection, the cavity resonator not being matched to the guide. Cases considered are (*a*) oscillator tuned to cavity resonance frequency: ratio of reflected to incident power 1 : 3; and (*b*) oscillator frequency varying around resonance frequency.

538.3 **1951**

Field Equations for a Fluid/Electromagnetic-Field System.—Pham Mau Quân. (*C. R. Acad. Sci., Paris*, 7th Feb. 1955, Vol. 240, No. 6, pp. 598–600.) A relativistic generalization is presented of the macroscopic equations of electromagnetism.

538.3 **1952**

Cauchy's Problem in Relation to a Fluid/Electromagnetic-Field System.—Pham Mau Quân. (*C. R. Acad. Sci., Paris*, 14th Feb. 1955, Vol. 240, No. 7, pp. 733–735.) Equations derived previously (1951 above) are studied by an analysis of Cauchy's problem.

538.566 **1953**

Reflection of a Transient Electromagnetic Wave at a Conducting Surface.—J. R. Wait & C. Froese. (*J. geophys. Res.*, March 1955, Vol. 60, No. 1, pp. 97–103.) A treatment of oblique-incidence reflection from the plane interface of a dissipative medium. The inversion of the Laplace transforms can only be carried out in closed form in special cases. Series solutions are developed for the general case and numerical results are presented graphically. A possible application of the results to the case of a lightning-discharge waveform and reflection from a sharply bounded ionosphere is noted.

538.566 : 517 **1954**

An Integral Equation governing Electromagnetic Waves.—P. R. Garabedian. (*Quart. appl. Math.*, Jan. 1955, Vol. 12, No. 4, pp. 428–433.) The problem discussed is that of determining the solution of the Helmholtz equation $\Delta u + k^2 u = 0$ for the region outside a simple closed-curve boundary at which values of u or its normal derivatives are prescribed. By introducing a suitable parameter, constructed by conformal mapping, the problem is reduced to a new Fredholm integral equation whose solution is independent of conditions inside the boundary. Scattering cross-section is discussed.

538.566 : 535.42] + 534.26 **1955**

Green's Functions for the Cylinder and the Sphere.—W. Franz. (*Z. Naturf.*, Sept. 1954, Vol. 9a, No. 9, pp. 705–716.) The investigation of diffraction [1665 of 1953 (Franz & Deppermann)] is continued. The exact expression for the Green's function is split into two parts corresponding respectively to the geometrical-optics wave and the surface wave. A semi-asymptotic solution is thus obtained which is valid for quite small obstacles. The surface waves are shown to be identical with the residual waves discussed by Watson and by van der Pol & Bremmer in connection with wireless telegraphy.

538.566 : 535.42/.43 **1956**

Backscattering from Wide-Angle and Narrow-Angle Cones.—L. B. Felsen. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 138–151.) "Solutions are obtained for the diffraction of the waves radiated by scalar and vector point sources on the axis of a semi-infinite cone. The scalar problems are solved by the method of characteristic Green's functions to yield directly various alternative representations whose different convergence properties are discussed; the vector problem is solved by an application of spherical transmission line theory. To evaluate the plane wave scattering observed far from the cone tip, a highly convergent contour integral representation is selected and evaluated approximately for the special case of backscattering from cones having large and small apex angles. The results for the large-angle cone exhibit the transition from a backscattered spherical wave to a plane wave as the cone degenerates into an infinite plane."

538.566 : 535.42 **1957**

Measurement of Microwave Diffraction from a Long Slit in a Thin Conducting Plane.—J. L. Hirshfield & C. M. Zieman. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 135–137.) An outline is given of technique used to produce a uniform incident plane wave. Results of measurements of the intensity of the diffraction field are shown graphically for longitudinal and transverse polarization of the incident wave.

538.566 : 535.42 **1958**

Diffraction by Apertures.—C. Huang, R. D. Kodis & H. Levine. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 151–165.) Theoretical and experimental investigations are reported of the diffraction of plane e.m. waves by circular and elliptical apertures in plane screens. Integral equations are derived for the distribution over the apertures and the aperture transmission coefficient is determined by a variational method. The closeness of the agreement between experimental and theoretical results shows that the method is capable of providing good approximations to the actual field values. The measurements were made in the 24-kMc/s band, using an image-plane technique.

538.566 : 535.42 **1959**

The Edge Conditions and Field Representation Theorems in the Theory of Electromagnetic Diffraction.—A. E. Heins & S. Silver. (*Proc. Camb. phil. Soc.*, Jan. 1955, Vol. 51, Part 1, pp. 149–161.) Discussion is presented relevant to the case of a perfectly conducting screen of infinite extent with an aperture of finite area. Order conditions are developed which must be satisfied by the field components in the neighbourhood of the edge as a consequence of the requirement that the total energy in a finite volume must be finite. The boundary-value problem is formulated as a pair of simultaneous integral equations. From the solution for conduction in polar semiconductors [381 of 1954 (Howarth & Sondheimer)] is extended to deal with effects occurring in the presence of a magnetic field. Hall coefficient and magnetoresistance effect are shown graphically as functions of the magnetic field strength and of the temperature and degree of degeneracy of the electron gas. At low temperatures the magnetoresistance effect may become very large, contrary to the prediction of the free-path theory.

537.311.62 **1933**

Theory of Skin Effect in Constant Magnetic Field.—M. Ya. Azbel'. (*C. R. Acad. Sci. U.R.S.S.*, 21st Jan. 1955, Vol. 100, No. 3, pp. 437–440. In Russian.) The surface impedance is calculated for the case of a metal surface parallel to the magnetic field. An analogous treatment for a normal field was given earlier by Azbel' & Kaganov (2624 of 1954).

537.311.62 **1934**

Current Distribution in Cylindrical Conductors of Circular Cross-Section.—G. Freud. (*Acta tech. Acad. Sci. hungaricae*, 1955, Vol. 10, Nos. 3/4, pp. 397–406. In German.) A calculation is made of the current distribution and Joule heating for the conductor in a uniform alternating magnetic field.

537.52 **1935**

The Electron Avalanche and its Development in the Self-Maintained Discharge.—H. Raether. (*Z. angew. Phys.*, Jan. 1955, Vol. 7, No. 1, pp. 50–56.) A survey of the primary and secondary processes leading to breakdown in a parallel-plate system in a gas.

537.52 **1936**

Departure from Paschen's Law of Breakdown in Gases.—W. S. Boyle & P. Kisliuk. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 255–259.)

537.52 **1937**

Breakdown Processes in Nitrogen, Oxygen, and Mixtures.—E. L. Huber. (*Phys. Rev.*, 15th Jan. 1955, Vol. 97, No. 2, pp. 267–274.)

537.523 **1938**

Influence of Insulating Films on the Corona Current and Breakdown Voltage of Spark Gaps.—C. H. Hertz. (*Ark. Fys.*, 20th Jan. 1955, Vol. 9, Part 1, pp. 1–28. In German.) Experiments are reported in which a point-to-plate discharge path was used, the plate being coated with lacquer or other insulator; observed breakdown voltages are in some cases lower than with an uncoated plate. An explanation of the results is presented.

537.523 **1939**

The Effect of Lacquer Films on the A.C. Corona on Points and Wires.—C. H. Hertz. (*Ark. Fys.*, 20th Jan. 1955, Vol. 9, Part 1, pp. 29–37. In German.)

537.523 **1940**

Two Different Breakdowns between a Positive Electrode with Small Curvature and a Plane.—R. Siksna. (*Ark. Fys.*, 20th Jan. 1955, Vol. 9, Part 1, pp. 77–82.) Experiments made using loops of different radii in combination with a plane are described.

537.523 **1941**

Some Peculiarities of the Current-Potential Characteristics of Positive Corona Discharge.—R. Siksna. (*Ark. Fys.*, 20th Jan. 1955, Vol. 9, Part 1, pp. 83–91.)

537.523.3 **1942**

Indication of the Development Stages of Positive Corona Discharge in the Atmospheric Air.—H. Norinder & R. Siksna. (*IVA, Stockholm*, 1955, Vol. 26, No. 2, pp. 46–57. In English.) Experimental technique is described for investigating the development of the discharge by means of the various optical, acoustic and electrical effects involved; the correlation between these effects is demonstrated.

537.523.5 : 538.561 **1943**

Radiation of Plasma Noise from Arc Discharge.—T. Takakura, K. Baba, K. Nunogaki & H. Mitani. (*J. appl. Phys.*, Feb. 1955, Vol. 26, No. 2, pp. 185–189.) Radiation from cold-cathode d.c. arc discharges in air has been observed at frequencies of 3·3 kMc/s, 190 Mc/s, 15 Mc/s and 1·5 Mc/s. The oscillation is thought to be generated by periodic electron emission from the cathode caused by a small perturbation of the potential gradient due to variation of the ion sheath potential.

537.525 **1944**

Electron Resonance in Gas Discharges.—D. J. E. Ingram & J. G. Tapley. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 238–239.) Brief description of experiments in which absorption lines were observed by paramagnetic-resonance technique, using a cavity resonator constructed so that the gas discharge occupied the region of maximum microwave magnetic-field strength. The results indicate that this may constitute a sensitive method for studying the variation of concentration of free ions.

537.525 **1945**

Space-Charge Effects in a High-Frequency Discharge: Part 1.—M. Chenot. (*J. Phys. Radium*, Jan. 1955, Vol. 16, No. 1, pp. 54–61.) Details of experimental work on the effect reported in 2189 of 1952. The current flowing in a circuit connecting the external electrodes and including a high resistance R is measured, and its relation to the applied voltage and to the p.d. between the internal electrodes examined. When R is very high, discontinuities in the characteristic and hysteresis effects are observed with change in applied voltage. The latter are studied in further detailed oscillograms. A theoretical explanation of the results is discussed.

537.525 : 621.396.822 **1946**

Noise of Gas Discharge Plasma.—S. Kojima, K. Takayama & A. Shimauchi. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 802–804.) Measurements were made in the frequency range 1–10 Mc/s on a 60-mA discharge in a 45-cm tube containing argon and Hg vapour at a pressure of about 2 mm Hg; probe currents of 83 and 220μA were used. Current noise was approximately proportional to $1/f$, as with semiconductors. See also 1133 of 1951 (Kojima & Takayama).

537.525.083 **1947**

An Evaluation of Plasma-Ion Temperature.—O. Shimada. (*J. phys. Soc. Japan*, Sept./Oct. 1954, Vol. 9, No. 5, pp. 874–876.) Measurements made by the double-probe and other methods are reported.

537.533.8 **1948**

Energy Distributions of Field-Dependent Secondary Electrons.—F. A. Brand & H. Jacobs. (*Phys. Rev.*, 1st Jan. 1955, Vol. 97, No. 1, pp. 81–84.) Report of an experimental investigation of the emission from thin films of MgO; a retarding-field technique was used. The energy distribution was found to be Maxwellian,

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 **2174**

The Propagation of Sound Pulses along Metal Bars.—W. Güth. (*Acustica*, 1955, Vol. 5, No. 1, pp. 35–43. In German.) The stationary-phase method is applied in developing the theory of pulse propagation along a bar. Experiments using schlieren technique were made on cylindrical steel bars immersed in water, with an electric spark as pulse source. Agreement of results with theory was satisfactory. In the case of thick bars, a wave of higher order was observed, presumably the first-order skew-symmetric wave.

534.213 **2175**

Sound Propagation in the Atmosphere and Audibility of Warning Signals in Ambient Noise.—P. Baron. (*Ann. Télécommun.*, Oct. 1954, Vol. 9, No. 10, pp. 258–274.) An account of experiments carried out in 1938–1939 in the Vals d'Yonne district and in Paris. Meteorological and sound-pressure measurements were made. Raising the sound source from ground level to 37 m produced a marked increase of received sound power for distances < 1 km. A mean curve of propagation was derived from the experimental data. The directional effect of the wind makes it desirable to have several sound sources to cover a given area. The degree of audibility satisfactory in the presence of noise was determined in a series of laboratory experiments. Computation shows that two sources having a combined power equal to that of a single source have a greater range.

534.64 : 534.2 **2176**

Tubes and Resonators. Computation and Measurement of some Acoustic Resistances.—J. Guittard. (*Acustica*, 1955, Vol. 5, No. 1, pp. 7–18. In French.) Assuming that the linear dimensions of the enclosed space are small compared with $\lambda/4$, where λ is the wavelength of the sound, acoustic resistance is computed from elementary theory for a circular aperture in a thin wall, for a tube opening on to (*a*) a semi-infinite and (*b*) an infinite space, and for a discontinuity of tube cross-section. Satisfactory agreement between theory and experiment is found.

534.78 : 621.39 **2177**

The Effect of Severe Amplitude Limitation on Certain Types of Random Signal: a Clue to the Intelligibility of 'Infinitely' Clipped Speech.—Dukes. (See 2412.)

534.833 **2178**

Subjective Assessment of Sound Insulation, using Electrical Simulation of Transmission-Loss Curves.—H. J. Rademacher. (*Acustica*, 1955, Vol. 5, No. 1, pp. 19–27. In German.)

534.85 **2179**

Frequency Irregularity in Rooms.—A. F. B. Nickson & R. W. Muncey. (*Acustica*, 1955, Vol. 5, No. 1, pp. 44–47.) The sounds of the speaking or singing voice and of musical instruments are often modulated in frequency and/or contain transients. These are the sounds of real importance in assessing the acoustic characteristics of auditoria. Frequency irregularity measurements using only pure tones may, therefore, give misleading results. Experiments with tones modulated in frequency at 6 c/s over a range of ± 3% show that the frequency-irregularity curves for such tones are much smoother than the corresponding ones for pure tones.

534.86 : 621.396.712.3 **2180**

On the Structural and Room Acoustics of the Multipurpose Studio Unit at Broadcasting House, Hamburg.—G. Venzke. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 11/12, pp. 229–236.) The two-storey building contains two groups of studios designed principally for recording plays. These comprise two 'dead' studios, two studios with normal reverberation time, two studios in which the reverberation time can be changed, and one underground reverberation room. Reverberation-time/frequency curves are shown and results of measurements of the sound insulation achieved by the double-leaf, floating-floor construction of the studios are noted.

621.395.6 : 621.372.5 **2181**

Equivalent Quadripole Networks for Electromechanical Transducers: Part 1.—W. Reichardt & A. Lenk. (*Acustica*, 1955, Vol. 5, No. 1, pp. 1–6. In

German.) E.s., e.m. and electrodynamic transducers are considered, with particular reference to the frequency-independent transformer or gyrator used as the coupling element between the electric and mechanical elements.

621.395.61 + 621.395.623.7].012.12 **2182**

Directivity Characteristics of Electroacoustic Transducers.—A. C. Raes. (*Ann. Télécommun.*, Nov. 1954, Vol. 9, No. 11, pp. 313–314.) A method of obtaining the polar characteristics of loudspeakers and microphones is described which does not require the use of an anechoic chamber. The transducer under test and the recording instrument are arranged at distances from the reflecting wall such that the characteristic can be recorded during the period preceding the arrival of the reflected sound.

621.395.623.8 **2183**

Sound System for Plenary Hall of United Nations General Assembly Building.—C. W. Goyder & L. L. Beranek. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1955, Vol. 16, No. 2, pp. 38–44; *Convention Record Inst. Radio Engrs*, 1953, Part 3, pp. 26–34.) This specially designed sound-reinforcement system has a linear frequency response over the range 300 c/s–6 kc/s. Time-delay systems are used to improve intelligibility. Measured performance characteristics are presented.

621.395.625.3 : 621.397.6 : 778.5 **2184**

Methods of Picture-Synchronized Sound Recording in Television.—Gondesen. (See 2450.)

AERIALS AND TRANSMISSION LINES

621.372.2 **2185**

Theory of the Harms-Goubau Wire Waveguide at Metre Wavelengths.—G. Piefke. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 81–93.) Whereas at centimetre and decimetre wavelengths thin dielectric layers provide adequate concentration of the wave energy, at metre wavelengths, and particularly for dealing with bends, thick dielectric layers are required. Theory is developed for this case, and is extended to include the use of a separate dielectric tube shielding the line from precipitation. Both the leakage attenuation and the resistive attenuation increase with rising frequency, the former increasing also as dielectric constant decreases. For a given degree of energy concentration, the attenuation has a minimum value for a particular value of wire radius, but this value may be unacceptable for economic reasons. Attenuation due to a coating of ice on the line is investigated. Neglecting icing effects, a relay section of length 15 km with a loss of 5 N at 1 m λ is practicable.

621.372.2 + 621.372.54]: 512.831 **2186**

The Matrix Approach to Filters and Transmission Lines.—Fisher. (See 2231.)

621.372.21 : 621.396.67 **2187**

The Behaviour of the Open End of a Coaxial Line.—V. Pfirrmann. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 8–12.) A theoretical study is made of the field pattern and variations at the junction of a coaxial line and a circular waveguide; the method of least squares is used. Particular cases treated are (*a*) frequency below the cut-off value for the waveguide, and (*b*) radiation conditions, the waveguide being excited in the E_{01} mode.

621.372.221 : 621.395.97 **2188**

Programme Circuits on Cable Pairs Loaded at 500-Yard Intervals.—J. L. W. Morgan & W. S. Ash. (*P.O. elect. Engrs' J.*, Jan. 1955, Vol. 47, Part 4, pp. 193–196.) Cable links between telephone exchanges which will be suitable for normal traffic when not required for B.B.C. programme circuits for outside broadcasts are obtained by loading standard cable pairs with 22-mH coils at 500-yd nominal spacing. Sufficient tolerance on the spacing to permit existing jointing chambers to be used is achieved by artificially increasing the mutual capacitance of the circuits.

621.372.8 **2189**

Propagation of a Signal in a Waveguide.—P. Poincelot. (*Ann. Télécommun.*, Nov. 1954, Vol. 9, No. 11, pp. 315–317.) An approximate formula is derived for the amplitude of the signal at a given time. Its application is illustrated by a numerical example for a guide of length 3 km and radius 3·825 cm. The duration of the initial transient state is found to be proportional to the square root of the length.

621.372.8 **2190**

Stability of the H_{01} Mode in Circular Waveguides, and the Occurrence of Harmonic Modes on Deformation to an Elliptical Cylinder.—J. Kornfeld. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 29–38.) Analysis involving use of Mathieu functions is presented. A numerical example indicates that a 10% deformation gives rise to an H_{11} wave whose amplitude is about 0·15 that of the original H_{01} wave.

621.372.8 : 538.614 **2191**

Propagation of Electromagnetic Waves in an Anisotropic Gyromagnetic Medium in a Rectangular Waveguide.—A. Chevalier, T. Kahan & E. Polacco. (*C. R. Acad. Sci., Paris*, 21st March 1955, Vol. 240, No. 12, pp. 1323–1324.) Analysis is presented for the case where the gyromagnetic medium is made anisotropic by application of a magnetic field perpendicular to the direction of propagation. General expressions are derived for the three electric-field components.

621.372.8 : 621.318.134 **2192**

Temperature Dependence of the Microwave Properties of Ferrites in Waveguide.—B. J. Duncan & L. Swern. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 623–624.) Report of an experimental investigation on a rod of ferramic A-106 in a waveguide of internal diameter 0·937 in., with a static magnetic field parallel to the direction of propagation. The results indicate that at some temperature between 23° and 500°C the ferrite absorption loss for this specimen is practically independent of frequency.

621.396.67 + 621.397.62 **2193**

New Television Receivers and Aerials [in Western Germany].—W. W. Diefenbach. (*Funk-Technik, Berlin*, Feb. 1955, Vol. 10, No. 4, pp. 88–91.) A brief survey of commercially available equipment.

621.396.67 **2194**

Scattering of Electromagnetic Waves by Wires and Plates.—D. B. Brick : J. Weber. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, p. 628.) Comment on 930 of April and author's reply.

621.396.67 **2195**

Method of Measurement of Aerial Gain by Electrical Integration of the Characteristic Function.—J. Munier. (*C. R. Acad. Sci., Paris*, 28th March 1955, Vol. 240, No. 13, pp. 1411–1413.) An arrangement is described which operates in conjunction with a polar-diagram recorder with square-law receiver to give a direct reading of the gain for aerials with rotationally symmetrical characteristics. The a.f.

output of the receiver is applied to the primary of a rotating transformer mechanically coupled to the rotating aerial support; the secondary voltage is detected by means of a rectifier whose time constant is large compared with the a.f. period.

621.396.67 : 621.372.2 **2196**

Gap Problem in Antenna Theory.—R. King. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 317–321.) Discussion indicates that the so-called gap problem [see e.g. 24 of 1948 (Infeld)] is more properly to be considered as a problem of the coupling between the transmission line and the aerial.

621.396.67 : 621.396.93 **2197**

Aerials for Mobile Radio Services.—W. Stöhr & D. Bassler. (*Frequenz*, Dec. 1954, Vol. 8, No. 12, pp. 357–368.) A survey covering wide-band aerials comprising full-wave dipoles, corner reflectors, collinear aerials, Yagi arrays, multichannel $\lambda/4$ radiators and folded dipoles, all for metre wavelengths.

621.396.67.012 **2198**

Wave Launching from a Conical Aerial.—V. Pfirrmann. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 98–101.) The near field of a $\lambda/4$ conical aerial is computed, and the wave-launching mechanism is illustrated by field patterns.

621.396.67.095.12 **2199**

Elliptic Polarization of Electromagnetic Radiation.—M. Bouix. (*Ann. Télécommun.*, Oct.–Dec. 1954, Vol. 9, Nos. 10–12, pp. 275–281, 298–304 & 345–351.) Fundamental formulae are developed in detail, and the general expressions of Kottler and Goudet are adapted for elliptic polarization. The results are used to obtain formulae for the gain and effective surface area of aerial systems.

621.396.674.1 : 621.318.134 **2200**

Ferrite-Cored Antennae.—C. A. Grimmett. (*Proc. Instn Radio Engrs, Aust.*, Feb. 1955, Vol. 16, No. 2, pp. 31–35. Discussion, pp. 36–37; *Convention Record Inst. Radio Engrs*, 1954, Part 7, pp. 3–7.) A survey of developments in the use of this type of aerial for reception of broadcast at 540 kc/s–1·6 Mc/s. The influence of length, diameter, winding and core material on sensitivity is discussed; ferrite-cored and air-cored aerials are compared.

621.396.674.3 : 621.372 **2201**

The Radiation of a Hertzian Dipole over a Coated Conductor.—D. B. Brick. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 104–121. Digest, *ibid.*, Part B, May 1955, Vol. 102, No. 3, pp. 392–395.) The study presented was undertaken in an effort to explain certain characteristics of an aerial field pattern measured over an aluminium ground screen presumed to have a thin coating of aluminium oxide. Analysis is given for the case where the dipole is (*a*) above the dielectric coating, (*b*) in the dielectric coating, and (*c*) lying in the conductor/dielectric interface. Values of the field potentials are obtained for both electric and magnetic dipoles. The power from the dipole is partly radiated and partly surface-guided; numerical values for the ratio between the two are derived for some particular cases.

621.396.676 **2202**

Aircraft Antennas.—J. V. N. Granger & J. T. Bolljahn. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 533–550.) A survey of aerials for communication and navigation on conventional aircraft.

621.396.677.45 **2203**

Radiation Characteristics of a Conical Helix of Low Pitch Angle.—J. S. Chatterjee. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 331–335.) Experiments are reported on a conical helix with a pitch angle much smaller than in the previous investigation (2899 of 1953) and with a larger ground plane. Mounted with the apex at the bottom and a short distance above the ground plane, the arrangement provided radiation in the axial direction over a frequency range of 100–500 Mc/s. Radiation pattern and current distribution along the helix were determined experimentally; the radiation pattern is also determined by computation, assuming a linear current distribution.

621.396.677.85 **2204**

Virtual Source Luneberg Lenses.—G. D. M. Peeler, K. S. Kelleher & H. P. Coleman. (*Trans. Inst. Radio Engrs*, July 1954, Vol. AP-2, No. 3, pp. 94–99.) An investigation is made of lenses formed by portions of a spherical Luneberg lens bounded by a pair of plane reflectors intersecting along a diameter; wedge angles up to 180° are considered. Multiple virtual sources corresponding to the reflections of the feed point can be obtained. Calculations are made of the positions of these virtual sources and the width of the corresponding beam. Methods of eliminating undesired beams include the placing of absorptive material at the edges of the lens. Data obtained experimentally on a two-dimensional lens with wedge angle of 180° are in good agreement with calculated values.

AUTOMATIC COMPUTERS

681.142 **2205**

Computer for Universal Application.—(*Elect. Times*, 24th Feb. 1955, Vol. 127, No. 3303, pp. 319–320.) Brief description of DEUCE, a commercially available computer developed from the ACE; it has punched-card input and output systems, mercury delay lines for short-term storage and a magnetic recording drum for long-term storage. The total floor space occupied by the equipment is 14 ft by 4 ft 6 in.

681.142 **2206**

An Outline of an Electronic Arithmetic Unit.—W. Woods-Hill. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 212–217.) Discussion of the design of a digital-computer unit capable of performing and checking the operations represented by $A \times B \pm D = C$.

681.142 **2207**

Pulse-Switching Circuits using Magnetic Cores.—M. Karnaugh. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 570–584.) Design theory is presented for nonstorage uses of cores with rectangular hysteresis loops in digital computers. To facilitate determination of the sense of the e.m. processes a method of representation due to Mayer is used in which the magnetic-circuit elements are replaced by elements of a mirror system. Devices for eliminating output voltage on 'shuttling' the core are discussed. Operating frequencies > 100 kc/s are attainable. 31 references.

681.142 **2208**

A Statistical Method for Solution of the Laplace Differential Equation using Electronic Computers.—H. Harmuth. (*Acta phys. austriaca*, Dec. 1954, Vol. 9, No. 1, pp. 27–32.) An electrical analogue of the Galton board is used in which the rolling balls are replaced by pulses and the pins by pulse-storage units.

681.142 : 621.37 : 535.32 **2209**

Analogue Machine for Calculation of the Complex [refractive] **Index of a Body from its Reflection Coefficient.**—M. Hénon. (*C. R. Acad. Sci., Paris*, 21st March 1955, Vol. 240, No. 12, pp. 1305–1306.) A resistance network is discussed by means of which the phase shift of light reflected by a body can be calculated if the reflection coefficient is known for all wavelengths; the refractive index can hence be determined.

681.142 : 621.385.832 **2210**

The Function of Basic Elements in Digital Systems.—C. B. Speedy. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 49–56. Digest, *ibid.*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 677–679.) The three basic elements of digital computers are (*a*) a bistable element for storing a digit, (*b*) a gate for controlling the passage of a digit, (*c*) a diode for controlling the direction of passage. A unit in the form of a beam deflection valve has been designed including a bistable element together with two gating elements. See also 2485 below.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.011.21.012 **2211**

The Geometric Transformation of Impedance Diagrams.—A. Železnikar. (*Telefunken Ztg*, Dec. 1954, Vol. 27, No. 106, pp. 252–253.) An extension of the work of Briner & Graffunder (2576 of 1953) to the general case. For a correction to the earlier paper see *ibid.*, Dec. 1954, Vol. 27, No. 106, p. 254.

621.3.042 : 621.396.822 **2212**

Barkhausen Noise from a Cylindrical Core.—D. Haneman. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 355–356.) The method used by Krumhansl & Beyer for calculating Barkhausen noise (298 of 1950) is simplified by considering an exciting field with a sawtooth rather than a sinusoidal waveform.

621.3.066.6 **2213**

The Variation with Current and Inductance of Metal Transfer between Platinum Contacts.—J. Riddlestone. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 29–34.) Continuation of investigation described previously [3495 of 1953 (Warham)]. Curves of the net transfer are given for currents and inductances in the ranges 1·8–7·6 A and 0·06–117 μH respectively. Four different types of transfer, termed 'bridge', 'short arc', 'long arc' and 'reversed short arc', may be involved. The results indicate that the life of Pt contacts could be improved by controlling the effective circuit inductance at break to about 0·6 μH.

621.314.223 **2214**

Analytical Approach to the Variable Turns-Ratio Autotransformers.—E. Mishkin. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, Aug. 1953, Vol. 72, pp. 669–673.)

621.314.7 : 621.375.4 **2215**

High-Frequency Amplification using Transistors.—E. Kettel. (*Telefunken Ztg*, Dec. 1954, Vol. 27, No. 106, pp. 245–251.) Measurements were made on transistors Type OC 601 and OC 602 in the grounded-base connection to assess them for use in narrow-band i.f. amplifiers. The voltage feedback effect may lead to instability, hence neutralization is essential. At the higher frequencies ($\sim$ 500 kc/s) the stage gain is reduced mainly by the base resistance and the collector barrier capacitance.

621.314.7.012.8 **2216**

Theory of Equivalent Circuits for Junction Transistors.—L. Oertel. (*Telefunken Ztg*, Dec, 1954, Vol. 27, No. 106, pp. 230–237.) An equivalent circuit is discussed which differs from that of Pritchard (2537 of 1954) only in respect of the arrangement of the current and voltage sources. A simplified equivalent circuit including a triode valve is also presented.

621.314.7.012.8 **2217**

The Frequency Dependence of [junction-] **Transistor Quadripole Parameters.**—E. Kettel & G. Meyer-Brötz. (*Telefunken Ztg*, Dec. 1954, Vol. 27, No. 106, pp. 237–245.) The grounded-base connection only is considered. Oertel's equivalent valve curcuit (2216 above) is a satisfactory approximation up to a frequency about half that of α cut off, but a proper description of r.f. performance requires the addition of a base resistance and leakage conductance to the basic equivalent circuit. Measurements on a Type-OC 601 transistor show satisfactory agreement with theory.

621.318.4 + 621.314.2] : 621.3.015.3 **2218**

Field Theory of Wave Propagation along Coils.—H. Poritsky, P. A. Abetti & R. P. Jerrard. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, Oct. 1953, Vol. 72. pp. 930–938. Discussion, pp. 938–939.) Expressions are derived for phase and group velocities and surge impedance in air-cored and iron-cored coils and transformer windings. Theoretical and experimental data for frequencies up to 600 kc/s are compared.

621.318.42 **2219**

The Design of Coils for the Production of High Magnetic Fields.—A. N. Ince. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 25–28. Digest, *ibid.*, Part A, Feb. 1955, Vol. 102, No. 1, p. 100.) Design curves are presented for coils of rectangular cross-section for producing intense transient magnetic fields, using energy obtained from a bank of charged capacitors.

621.318.57 **2220**

A Reversible Binary Counter.—R. W. Fenemore. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 204–206.) A multivibrator-type counter performs addition or subtraction depending on application of a control signal to a two-gate system interposed between consecutive counter stages. The control signal may be obtained from a multivibrator circuit similar to the counter stages. Applications in digital-analogue conversion and in an interpolator are discussed.

621.318.57 : 621.314.7 **2221**

Transistor Choppers for Stable D.C. Amplifiers.—R. L. Bright & A. P. Kruper. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 135–137.) Two fused-junction transistors driven at power frequency are used in a switching circuit for converting weak d.c. input signals into proportional square wave a.c. signals.

621.318.57 : 621.38 **2222**

Multi-electrode Counting Tubes.—K. Kandiah & D. W. Chambers. (*J. Brit. Instn Radio Engrs*, April 1955, Vol. 15, No. 4, pp. 221–232. Discussion p. 232.) Applications other than straightforward counting operations are discussed for decimal counting tubes of various types. The design of a pulse amplitude analyser using trochotrons and dekatrons in a matrix system is outlined. The life of the tubes is comparable to that of ordinary valves.

621.37 + 621.396.621].049.75 **2223**

Investigations of Laboratory Production of Printed Circuits for Communication Equipment.—W. Götze. (*Fernmeldetech. Z.*, Feb. 1955, Vol. 8, No. 2, pp. 83–88.) A brief report is presented on the practical aspects of very-small-scale production of printed circuits, using the simplest tools only. The electrical and mechanical properties of 12 different chassis materials are tabulated as well as the properties and the treatments required by seven different conducting materials. Applications described include the production of components, an amplifier, a *RC* oscillator and a heterodyne receiver for the frequency band 500 kc/s–15 Mc/s; this receiver contains no inductive components (see also 958 of 1953).

621.372.412 **2224**

Piezoelectrically - Activated Low - Frequency Mechanical Resonators.—J. F. W. Bell. (*J. sci. Instrum.*, Feb. 1955, Vol. 32, No. 2, pp. 52–54.) Discussion of resonators comprising plates or bars carrying two relatively small piezoelectric crystals. The parameters of the equivalent electrical quadripole are determined for flexural modes of some circular Chladni's plate type resonators. Application to stabilization of sinusoidal oscillators is briefly described.

621.372.5 **2225**

On the Physical Realizability of Linear Nonreciprocal Networks.—H. J. Carlin. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 608–616.) "The necessary and sufficient conditions are given that a matrix with arbitrary complex number elements be the impedance, admittance or scattering matrix of a physical linear reciprocal or non-reciprocal network. A canonical form for non-reciprocal network synthesis is presented which applies to any linear *n*-terminal pair (*n*-port) system at any fixed frequency. If the network is passive the only circuit element required in addition to lossless inductors, capacitors, transformers and positive resistors is the gyrator. If the network is active, negative resistors and gyrators must be used in addition to conventional passive elements. Some discussion of matrixes with frequency variable elements is also given."

621.372.5 **2226**

Transient Responses with Limited Overshoot.—A. J. O. Cruickshank. (*Wireless Engr*, June 1955, Vol. 32, No. 6, pp. 154–163.) "The problem is considered of designing a system transfer function such that, in the response to a step-function input, the overshoot shall be limited and consist largely of the principal mode of oscillation. A method is stated by which the size of any real term in the response may be calculated relative to the maximum value of the principal mode. Graphical conditions are given restricting the permissible pole and zero positions in certain cases when this ratio is specified. The procedure is illustrated by examples."

621.372.5 **2227**

Design of Parallel-T Resistance-Capacitance Networks.—Y. Oono. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 617–619.) Formulae are derived for networks having a transfer characteristic symmetrical with respect to resonance frequency and a minimum loss for a prescribed frequency discrimination.

621.372.5 **2228**

Symmetrical Quadripoles operated as [asymmetrical] **Transformers.**—A. Ruhrmann. (*Arch. Electrotech.*, 25th Nov. 1954, Vol. 41, No. 6, pp. 320–333.) A theoretical investigation is presented of the behaviour of passive, linear quadripoles in asymmetrical operation. The analysis is based on introduction of the characteristic iterative impedance. Multisection band-pass filters with different output and input impedances are built up with sections which have similar frequency characteristics and phase constants, but geometrically graduated impedances. A numerical example is given of a 30Ω/60Ω transformation for the 474–1570-kc/s frequency band.

621.372.54 **2229**

The Initial Transient Behaviour of Filters with Characteristic Amplitude Response.—H. H. Nissen & W. Händler. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 74–80.) The distortion of a step-voltage input by Butterworth-type and Tchebycheff-type filters is analysed. Calculations are made for all-pass equalizing networks for the former type.

621.372.54 **2230**

A Note on Time Series and the use of Jump Functions in Approximate Analysis.—A. J. O. Cruickshank. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 81–87. Digest, *ibid.*, Part II, Dec. 1954, Vol. 101, No. 84, p. 680.) The response of filters to jump-function inputs is investigated. Jump-transfer functions and serial operators for common types of filter are tabulated. The method is compared with that described by Tustin (*J. Instn elect. Engrs*, Part IIA, 1947, Vol. 94, p. 130).

621.372.54 + 621.372.2] : 512.831 **2231**

The Matrix Approach to Filters and Transmission Lines.—M. E. Fisher. (*Electronic Engng*, May & June 1955, Vol. 27, Nos. 327 & 328, pp. 198–204 & 258–263.) Use of matrices provides a direct and flexible method of treatment. A simple graphical procedure is indicated for investigating filter characteristics.

621.372.54 : 519.241.1 **2232**

A New Method of Determining Correlation Functions of Stationary Time Series.—Lampard. (See 2352.)

621.372.54 : 621.3.015.3 **2233**

The Transient Response of R.F. and I.F. Filters to a Wave Packet.—A. W. Gent. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 1–2.) Discussion on 963 of 1953.

621.372.56 : 546.289 : 538.63 **2234**

A Novel Microwave Attenuator using Germanium.—J. B. Gunn & C. A. Hogarth. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 353–354.) The device comprises a thin rectangular slab of Ge set obliquely across a waveguide, with current leads attached to the two ends and a magnetic field applied parallel to the face of the slab so as to control the concentration of current carriers as described by Weisshaar & Welker (3590 of 1954). Attenuation of 33 db was obtained with a pulsed control current of 60 mA.

621.372.6 **2235**

The Hybrid Ring—a Hybrid Circuit for Very High Frequencies.—C. Colani. (*Frequenz*, Dec. 1954, Vol. 8, No. 12, pp. 368–372.) Input admittance and coupling attenuation are calculated as functions of frequency; good agreement with measured values is obtained. Methods of increasing bandwidth are discussed and a practical arrangement is described for the 4-kMc/s band, using a construction similar to microstrip.

621.373 **2236**

Suggestions on constructing Oscillators.—J. Piesch. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, Jan./Feb. 1955, Vol. 9, Nos. 1/2, pp. 10–19.) The operation of various valve and transistor oscillators is analysed. Fixed and continuously tunable oscillators, pulse generators, and two-frequency oscillators for special applications are discussed.

621.373.2.029.65 **2237**

The Generation of Millimetre Waves.—J. L. Farrands. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 98–103. Digest, *ibid.*, Part B, March 1955, Vol. 102, No. 2, p. 264.) Theory is presented for spark generators; experimental evidence generally supports the theory. Useful results can only be obtained with sparks in oil.

621.373.42.029.4 **2238**

Ultra-low-Frequency Oscillator.—M. D. Armitage. (*Wireless Engr*, June 1955, Vol. 32, No. 6, pp. 173–174.) A *CR* circuit using resistors and polystyrene capacitors of moderate values is described for obtaining oscillations at frequencies down to < 1 c/s. The effective value of the resistance is increased by use of the cathode-follower effect.

621.373.421 **2239**

Parallel-Network Oscillators.—J. L. Stewart. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 589–595.) General principles are discussed of electronically tunable wide-band oscillators having two signal paths, with their outputs added, and a common feedback path; the tuning is performed by differentially controlling the gain in the two paths, e.g. by push-pull modulation. Particular arrangements described include a twin-triode circuit using an artificial-transmission-line network, giving a 2:1 tuning ratio, and a four-valve circuit with lead and lag networks, giving a frequency range nearly independent of centre frequency. Amplitude constancy, stability, waveform and noise are examined.

621.373.5 : [621.314.7 + 621.372.412 **2240**

A Simple Quartz Crystal Oscillator driven by a Junction Transistor.—H. G. Bassett. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 222–223.) The transistor is connected with grounded base and the quartz crystal is operated in its series mode. The frequency range is up to about 300 kc/s and the output power up to about 10 mW.

621.374.4 **2241**

Four-Decade Frequency Divider.—G. K. Jensen & J. E. McGeogh. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 154–158.) Division of any frequency from sub-audio to 450 kc/s by any whole number up to 10 999, is accomplished by a direct-reading divider using binary counter circuits.

621.375.2 : 621.372.2 **2242**

Design of Coaxial Cavities for Valves with Planar Electrodes.—L. Grifone. (*Alta Frequenza*, Dec. 1954, Vol. 23, No. 6, pp. 357–377.) The cavities form the double coaxial-line structure used in conjunction with a disk-seal-type valve for grounded-grid operation as amplifier or multiplier. A graphical method of design is presented, which involves only functions of the characteristic impedance, once the operating mode has been chosen. Criteria are explained for determining the diameters of the two cavities for optimum response. For higher-mode operation the response can be improved most easily by the introduction of a suitable discontinuity. Three types are considered. The occurrence of spurious resonances is also discussed.

621.375.2 : 621.396.41 **2243**

Design of H.F. and I.F. Amplifiers for Multichannel F.M. Links.—R. Schienemann. (*Telefunken Ztg*, Sept. & Dec. 1954, Vol. 24, Nos. 105 & 106, pp. 157–162 & 211–219. Correction, *ibid.*, Dec. 1954, Vol. 24, No. 106, p. 254.) Bandwidth required is determined (*a*) from the side-band amplitudes for given modulation index and (*b*) from the permissible distortion. Expressions for (*b*) involve the derivatives of the amplifier response curves and are tabulated for single-stage circuits and two-stage band-pass filters. The computation for multistage circuits is shown to involve the same derivatives. Under ideal conditions, second-harmonic distortion would be eliminated by exact tuning to the central frequency, and third-harmonic distortion sufficiently reduced by using symmetrical filters with a coupling coefficient $1/\sqrt{3}$. In practice, tuning is not exact, but second-harmonic distortion can be kept at a tolerable level by adjustment of the pass-band response at the alignment stage. Valve capacitance variations are allowed for in the shunt circuit capacitance. Neutralization can practically eliminate the effects of feedback via grid-anode capacitance. Criteria for the choice of i.f. are explained.

621.375.2.029.3 **2244**

Circuit Design Factors for Audio Amplifiers.—M. V. Kiebert, Jr. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 166–171.) Close regulation of the anode supply of a cathode-follower driver stage in a power amplifier is achieved by using a regulator triode operated by a diode connected to the driven grid. Circuits discussed include improved versions of Williamson and 'ultralinear' amplifiers.

621.375.2.029.3 **2245**

Design for a 20-Watt High-Quality Amplifier: Part 2.—W. A. Ferguson. (*Wireless World*, June 1955, Vol. 61, No. 6, pp. 279–282.) Details are given of the circuit, lay-out and performance of an amplifier with an output stage of two Type-EL34 high-slope pentodes in push-pull with partial screen-grid loading. Part 1: 1918 of July.

621.375.227 **2246**

A New Circuit for balancing the Characteristics of Pairs of Valves.—R. E. Aitchison. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 224–226.) A more detailed account of the work described previously (982 of April).

621.375.23.029.64 **2247**

X-Band Receiving Amplifier.—K. Ishii. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 202..210.) A regenerative klystron amplifier is described, suitable for use in a microwave television receiver, having a gain >16 db at 9·76 kMc/s, with a bandwidth of 20 Mc/s.

621.375.3 **2248**

Problems of Magnetic Pre-amplifiers.—F. Kümmel. (*Electrotech. Z., Edn A*, 1st Feb. 1955, Vol. 76, No. 3, pp. 113–120.) The topics discussed include the quality, the effect of core shape on the magnetization characteristic, effect of characteristic of valve or semiconductor rectifier on amplification, and effects of incomplete magnetic decoupling of input circuit.

GENERAL PHYSICS

53(083.7) **2249**

Representation of Physical Quantities in Formulae, Tables and Coordinate Systems.—C. Glinz. (*Tech. Mitt. schweiz. Telegr. TelephVerw.*, 1st Feb. 1955, Vol. 33, No. 2, pp. 41–69. In German.) A comprehensive discussion covering both fundamental physical principles and typographical aspects.

53.081.4 **2250**

A New System of Logarithmic Units.—J. B. Moore. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, p. 622.) Comment on 988 of April (Hartley).

530.112 **2251**

Proposal for a New Aether Drift Experiment.—D. D. Crombie. (*Nature, Lond.*, 19th Feb. 1955, Vol. 175, No. 4451, pp. 350–351.) A method of greater sensitivity than Essen's (2618 of 1954) uses a resonant cavity to produce a phase change in a signal from a fixed-frequency oscillator.

530.145 : 538.3 **2252**

Derivation of the Laws of Relativistic Electrodynamics for a Vacuum from the Energy-Quantum Model.—H. Zuhrt. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 47–51.) Theory developed previously (1627 of June) is extended to include the case of systems in motion.

530.145.6 : 621.385.833 **2253**

Wave-Mechanics Theory of Electron-Optical Image Formation: Part 1.—W. Glaser & G. Braun. (*Acta phys. austriaca*, Dec. 1954, Vol. 9, No. 1, pp. 41–74.)

537.21 : 621.3.013.78 **2254**

Electrostatic Averaged Boundary Conditions for Wire Mesh.—B. Ya. Moyzhes. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 167–176.) A brief review is given of the existing methods for determining the screening effect of a mesh, and a general derivation is proposed of the boundary condition for a mesh by the method of averaging the field. The results obtained are applied to the determination of the screening effect of an earthed uniform spherical mesh with respect to a charge or a dipole placed at the centre, and also to the determination of the effective potential in a triode. See also 2273 below.

537.212 : 621.317.39.082.72 **2255**

The Field due to an Infinite Dielectric Cylinder between two Parallel Conducting Planes.—C. Mack. (*Brit. J. appl. Phys.*, Feb. 1955, Vol. 6, No. 2, pp. 59–62.) If the cylinder radius, b, is sufficiently small compared with the other dimensions involved, the change of capacitance due to its insertion between the plates can be made proportional to $(K - 1)b^2/(K + 1)$, where K is the dielectric constant of the cylinder. For a conducting cylinder, K is put equal to infinity. Applications include the measurement of the departure from uniformity of threads.

537.226 : 537.311.35 **2256**

The Ionic Conductivity of Dilute Potassium Chloride Solutions at Centimetric Wavelengths.—V. I. Little & V. Smith. (*Proc. phys. Soc.*, 1st Feb. 1955, Vol. 68, No. 422B, pp. 65–74.) Measurements on solutions in the concentration range 0·005–1·0 normal, at a frequency of 3×10^9 c/s, indicate the existence of a strong dispersion region at concentrations below 0·5 normal, which may be explained in terms of the perturbations by the applied field of a shell of water molecules surrounding the ion at a mean distance of 6 Å.

537.226.2 : 546.212 : 621.317.335.3 **2257**

The Dielectric Constant of 'Free' and 'Bound' Water at Microwave Frequencies.—J. Baruch & W. Low. (*Bull. Res. Coun. Israel*, June/Sept. 1953, Vol. 3, Nos. 1/2, pp. 31–36.) An attempt is made to assess and summarize results obtained by the authors and by other workers on the dielectric dispersion of water, the water molecules in $CuSO_4.5H_2O$ in the temperature range from − 70°C to 150°C, water in hygroscopic salts, aqueous gels and thixotropic gels. Estimation of hydration is also considered. 39 references.

537.311.1 : 535.137 **2258**

The Theory of the Reflectivity of Metals.—R. Wolfe. (*Proc. phys. Soc.*, 1st Feb. 1955, Vol. 68, No. 422A, pp. 121–127.) The reflectivity of an ideal metal for infrared radiation is calculated by a quantum-mechanics method. Results agree with those obtained by Dingle (2626 of 1954) using classical methods; the diffuse-reflection wave functions correspond more closely than the specular-reflection wave functions to the actual electronic wave functions as indicated by experimental results.

537.311.6 : 621.315.514 **2259**

Skin and Spiraling Effect in Stranded Conductors.—J. Zaborszky. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, Aug. 1953, Vol. 72, pp. 599–602. Discussion, pp. 602–603.) An analysis is made to determine the a.c. resistance and internal reactance of stranded conductors with or without a magnetic core, at power frequencies, assuming current density constant in individual strands. The spiralling of strands tends to reduce skin effect. Data calculated for standard copper conductors with parallel and spiralled strands are listed.

537.52 : 537.226 **2260**

Theory of Breakdown of Inhomogeneous Dielectrics.—Yu. M. Volokobinski. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 74–80.)

537.525 **2261**

Formative Time-Lag Studies with High-Frequency Discharges.—A. W. Bright & H. C. Huang. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 42–45. Digest, *ibid.*, Part III, Nov. 1954, Vol. 101, No. 74, pp. 407–408.) Pulse techniques were used to study phenomena in coaxial-cylinder and parallel-wire systems, in the frequency range 1–15 Mc/s, where the discharge changes from corona type to one which completely crosses the gap. The breakdown voltage drops by about 13% above the critical frequency.

537.525 **2262**

Space-Charge Effects in a High-Frequency Discharge: Part 2.—M. Chenot. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 101–107.) Further discussion of results of experiments previously reported (1945 of July). Cathode disintegration phenomena, various shapes of characteristic, and factors affecting the direction and magnitude of the e.m.f. are considered.

537.533 **2263**

Field-Emission and Surface Phenomena.—F. L. Jones. (*Nature, Lond.*, 5th Feb. 1955, Vol. 175, No. 4449, pp. 244–245.) Brief report of a symposium held at Pittsburg in November 1954.

537.533 **2264**

Delayed Electron Emission from Metals.—K. Seeger. (*Naturwissenschaften*, Feb. 1955, Vol. 42, No. 3, p. 66.) Measurements were made on a W foil substituted for the usual photocathode in a multiplier cell. Emission was excited by bombarding with 1-keV electrons and measurements were started 5 min after the bombardment, the foil being simultaneously heated at a controlled rate. The emission/temperature curve passed through a maximum between 130° and 200°C. Emission was eliminated by prolonged heating at 1 000°C but was restored by exposing the foil to the atmosphere at 100°C and abrading it. The results support theory advanced by Nassenstein (87 of January).

537.533 **2265**

Electron Emission from Metal Surfaces after Mechanical Working.—J. Lohff & H. Raether. (*Naturwissenschaften*, Feb. 1955, Vol. 42, No. 3, pp. 66–67.) Measurements were made on various metals in gas at a pressure of about 2×10^{-5} Torr, using an electron multiplier. The surfaces were abraded with a steel brush within the vessel. Emission/time curves are shown for Pb, Ca, Al and Na; the activity of the elements is correlated with their position in the periodic system. Oxidation may be the cause of the emission, but no explanation of the mechanism is yet available.

537.533.8 **2266**

On the Escape Mechanism of Secondary Electrons from Insulators.—A. J. Dekker. (*Physica*, Jan. 1955, Vol. 21, No. 1, pp. 29–38.) Starting from the Boltzmann transport equation, and with certain simplifying assumptions, theory is developed which takes into account the interaction of secondary electrons with lattice vibrations, traps and occupied donor levels. At high trap densities, the secondary yield for high primary energies is inversely proportional to the square root of the trap density, at low trap densities yield is independent of trap density. Expressions for the temperature effect for high primary energies are derived for polar and nonpolar insulators. Results for the first case have been confirmed by experiment.

538.11 **2267**

Antiferromagnetism.—G. W. Pratt, Jr. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 926–932.) The nature of the spin coupling in the antiferromagnetic oxide MnO is discussed on the basis of a simplified model. The coupling between magnetic ions whose charge densities interact with an intervening nonmagnetic ion but not directly with each other is described as the result of the polarization of the nonmagnetic ion.

538.56 **2268**

Representation of Electromagnetic Field by Retarded Potentials.—I. S. Arzhanykh. (*C. R. Acad. Sci. U.R.S.S.*, 21st Feb. 1955, Vol. 100, No. 6, pp. 1053–1056. In Russian.) Applications considered include a boundary problem and the equation of motion of electron gas in vacuo.

538.566 + 534.2 **2269**

Electromagnetic and Acoustic Scattering by a Semi-infinite Body of Revolution.—C. E. Schensted. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 306–308.) Theory developed by Kline (646 of 1952) is used to determine the scattering of a plane wave incident along the axis of a perfectly reflecting body. For the case of a paraboloid the solution of the e.m. problem is obtained exactly in closed form. The results are compared with those obtained from consideration of current distribution, as in 2306 below.

538.566 + 534.2 **2270**

Electromagnetic and Acoustical Scattering from a Semi-infinite Cone.—K. M. Siegel, J. W. Crispin & C. E. Schensted. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 309–313.) Calculations of scattering cross-section for e.m. waves incident along the axis of the cone are made by the physical-optics method based on current distribution and by the exact method based on the appropriate field equations; the solutions are practically identical for cone semi-angles close to zero or $\pi/2$. The corresponding comparison is also made for acoustic waves.

538.566 : 535.42 **2271**

Studies of the Diffraction of Electromagnetic Waves by Circular Apertures and Complementary Obstacles: the Near-Zone Field.—M. J. Ehrlich, S. Silver & G. Held. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 336–345.) Measurements have been made of both magnetic and electric field strengths with diffracting apertures of diameter up to 36λ and normally incident waves. Experimental techniques for illuminating the aperture and probing the field are described; wavelengths around 3 cm afford a satisfactory compromise between reasonable overall dimensions on the one hand and reliability of measurements on the other. Results are shown graphically; the predicted uniformity of the tangential magnetic field in the aperture plane is confirmed.

538.566 : 537.5 : 523.72 **2272**

Nonlinear Theory of Space-Charge Wave in Moving, Interacting Electron Beams with Application to Solar Radio Noise.—H. K. Sen. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 849–855.) Consideration of the exact equations for interaction between two neutralized electron beams indicates that steady-state space-charge waves can be propagated in such a medium. The period of the wave depends on the amplitude and phase velocity. The oscillation is simple harmonic for small amplitudes but deviates progressively from this condition as the amplitude increases. Beyond a critical amplitude, whose value depends on the phase velocity, the oscillation waveform becomes discontinuous. The theory is used to estimate the relative intensity of the second-harmonic component in solar r.f. outbursts reported by Wild et al. (391 of 1954). Analysis based on theory of radiation from oscillating plasma leads to a value for the r.f. flux of the order of magnitude of that observed.

538.566 : 621.3.013.78 **2273**

Electrodynamic Averaged Boundary Conditions for Wire Mesh.—B. Ya. Moyzhes. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 158–166.) Equations (29) and (30) are derived which form a system of boundary conditions relating the averaged tangential components of the electric and magnetic fields on the surface of the mesh to the averaged surface density of the current in the mesh. The results obtained are illustrated by calculating the reflection of a plane wave from a plane uniform mesh, and by determining the screening effect of a spherical mesh with respect to a small turn of wire carrying a current and located at the centre of the sphere.

538.566.2 : 535.32 : [546.212 + 546.332.26 **2274**

The Refractive Index of Water and Aqueous Solutions of Sodium Sulphate at Metre Wavelengths.—I. S. Frolov. (*Zh. eksp. teor. Fiz.*, Oct. 1954, Vol. 27, No. 4(10), pp. 477–486.) Using the first method of Drude, the determination of the dependence of the refractive index of water on wavelength and temperature was extended to metre wavelengths and a temperature range from 2° to 32°C. Similar investigations were also carried out to determine the dependence on concentration of the refractive index of aqueous solutions of Na_2SO_4. The main conclusions reached are: (*a*) the refractive index in both cases increases linearly with temperature;

(*b*) there is no anomalous dispersion at metre wavelengths; (*c*) for a given temperature the refractive index of a solution increases with concentration.

538.569.4.029.64 : 535.338 **2275**

Application of Molecular Beams to Radiospectroscopic Study of Rotation Spectra of Molecules.—N. G. Basov & A. M. Prokhorov. (*Zh. eksp. teor. Fiz.*, Oct. 1954, Vol. 27, No. 4(10), pp. 431–438.) Molecular beams may be used to obtain narrow spectral lines, of width about 7 kc/s, and the rotation spectra of materials in the solid state. Quantitative estimates are made of the possibility of detecting the rotation transition $J = 1 \rightarrow J = 2$ in CsF molecules at a frequency of 17·7 kMc/s using a spectroscope with a waveguide absorption cell, and of the $J = 0 \rightarrow J = 1$ transition using a cavity-resonator instrument [see also 100 of January (Gordon et al.)].

539.233/.234 **2276**

Growth of Thin Films.—G. Cario & J. H. Kallweit. (*Z. Phys.*, 13th Jan. 1955, Vol. 140, No. 1, pp. 47–56.) An attempt is made to explain qualitatively the mechanism of growth on the basis of Frenkel's theory of adsorption. A summary is given of the most important parameters which may affect the structure of the film before, during, and after deposition.

548.0 : 53 **2277**

Investigation of the Natural Frequencies and Natural Oscillations of Imperfect Crystal Lattices.—E. Fues & H. Stumpf. (*Z. Naturf.*, Oct. 1954, Vol. 9a, No. 10, pp. 897–902.) A theoretical investigation.

538.3 **2278**

Electromagnetics. [Book Review]—J. D. Kraus. Publishers: McGraw-Hill, London, 1953, 604 pp., 76s. 6d. (*Nature, Lond.*, 26th Feb. 1955, Vol. 175, No. 4452, pp. 358–359.) A treatment of Maxwell's theory and some of its applications; suitable as a reference book for research workers. Mathematical functions entering into the solution of wave equations are dealt with in an appendix.

538.569.4 : 535.33 **2279**

Microwave Spectroscopy. [Book Review]—W. Gordy, W. V. Smith & R. F. Trambarulo. Publishers: J. Wiley & Sons, New York, and Chapman & Hall, London, 1953, 446 pp., 64s. (*Nature, Lond.*, 12th Feb. 1955, Vol. 175, No. 4450, p. 273.) Includes chapters on spectroscope technique and design, on measurements on gases, liquids and solids, on nuclear properties, on molecular structure, and on further possible applications of microwaves.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.5 **2280**

The Diffusion of Ionized Meteor Trails in the Upper Atmosphere.—J. S. Greenhow & E. L. Neufeld. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 133–140.) The variation with height of the duration of radio echoes from meteor trails is discussed. For the experimental conditions involved, echo duration decreases approximately exponentially with increased height, in agreement with diffusion theory. The diffusion coefficient is between 10^4 and 10^5 cm^2/s, in agreement with estimates based on rocket determinations of upper-air density.

523.5 : 537.564 **2281**

Collision Processes in Meteor Trails.—H. S. W. Massey & D. W. Sida. (*Phil. Mag.*, Feb. 1955, Vol. 46, No. 373, pp. 190–198.) Momentum-loss cross-sections for impacts between meteor atoms and atmospheric molecules are calculated. The values of the ionization cross-section derived from them are in agreement with those derived earlier by Bates and Massey (*Phil. Mag.*, Feb. 1954, Vol. 45, No. 361, pp. 111–122.) The diffusion of ionization in a meteor trail is also discussed in relation to known mobilities of positive ions in gases.

523.72 : 538.566 : 537.5 **2282**

Nonlinear Theory of Space-Charge Wave in Moving, Interacting Electron Beams with Application to Solar Radio Noise.—Sen. (See 2272.)

523.72 : 621.396.822.029.62 **2283**

Character of 200-Mc/s Solar Noise Observation Equipment installed at Hiraiso Radio Wave Observatory.—T. Takahashi, M. Onoue & K. Kawakami. (*J. Radio Res. Labs, Japan*, Sept. 1954, Vol. 1, No. 6, pp. 41–53.) Principles of measurement and accuracy of equipment installed in March 1952 are discussed. Routine observations started in August 1954. The path of the sun is followed by a beam aerial system rotated 2° every eight minutes, with manual adjustment daily for change of declination. During one minute in every eight the receiver input is connected to a noise generator for calibration purposes. The double-superheterodyne receiver has a bandwidth of about 80 kc/s. Results are compared with data from other stations.

523.74 + 551.510.535] : 537.311.37 **2284**

Solar Electrodynamics.—J. W. Dungey. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 88–90.) The reduction in conductivity of an ionized gas by a magnetic field and the effect of a polarization electric field are discussed. The theory has a bearing on conditions in the solar atmosphere above sunspots and on tidal oscillations in the ionosphere.

523.75 : [551.510.535 + 550.38 **2285**

Geophysical Aspects of Solar Flares.—V. C. A. Ferraro. (*Nature, Lond.*, 5th Feb. 1955, Vol. 175, No. 4449, pp. 242–244.) Report of a discussion held at the Royal Astronomical Society in November 1954. Results of research on the geomagnetic and ionospheric effects of the flares were surveyed.

523.755 : 523.16 : 621.396.822 : 523.99 **2286**

The Irregular Structure of the Outer Regions of the Solar Corona.—A. Hewish. (*Proc. roy. Soc. A*, 22nd Feb. 1955, Vol. 228, No. 1173, pp. 238–251.) Records obtained in 1952 of the radiation from the radio star in Taurus [98 of 1953 (Machin & Smith)] and results of measurements made in June 1953, using aerials of greater directivity, cannot be explained in terms of absorption or large-scale refraction effects in the solar corona, but are consistent with a scattering theory. An estimate is made of the size and the electron density of the coronal irregularities in the range of distance 5–15 $R_{\odot}$, where $R_{\odot}$ is the solar radius. The irregular structure may represent an extension of the visible coronal rays.

550.384 **2287**

Recent Progress in the Theory of the Main Geomagnetic Field.—S. K. Runcorn. (*Sci. Progr.*, Jan. 1955, Vol. 43, No. 169, pp. 13–27.)

550.386 : 523.75 **2288**

Particularly Large Chromospheric Eruptions and Geomagnetic Activity.—P. Simon. (*C. R. Acad. Sci., Paris,* 7th March 1955, Vol. 240, No. 10, pp. 1056–1058.) Further analysis of observations indicates that geomagnetic activity related to the appearance of certain eruptions can be distinguished from that related to the central meridional passage of certain sunspots (1973 of July).

551.510.5 **2289**

Ion Production Rate in an Atmosphere of Exponentially Rising Temperature with Height.—H. Kamiyama. (*Sci. Rep. Tohoku Univ., 5th Ser., Geophys.,* Aug. 1954, Vol. 6, No. 1, pp. 11–18.) An expression is derived for the height distribution of the ion production rate, assuming that temperature varies exponentially with height and also depends on the solar zenith distance. Results are similar to those of Chapman for heights up to about 100 km. In the F_2 region the maximum rate of ion production and the height at which it occurs vary anomalously with solar zenith distance.

551.510.535 **2290**

Mechanism of Creation of Ionospheric Inhomogeneities.—B. N. Gershman & V. L. Ginzburg. (*C. R. Acad. Sci. U.R.S.S.,* 1st Feb. 1955, Vol. 100, No. 4, pp. 647–650. In Russian.) Results of approximate calculations indicate that a negative temperature gradient of about 10^{-4} deg/cm, or greater, at a height of about 400 km could result in thermal convection currents such as would produce inhomogeneities and high-velocity winds in the ionosphere. The temperature at 300–400 km is assumed to be about 1 000°–3 000°.

551.510.535 **2291**

Studies on the Sunrise Effect in Regions E and F.—S. S. Baral. (*J. atmos. terr. Phys.,* March 1955, Vol. 6, Nos. 2/3, pp. 160–170.) To be effective in causing ionization in a night-time layer, solar radiation must pass above the day-time height of the layer. The observed delay in time of sunrise effect is due therefore to the difference between the night-time and day-time heights of the layer considered. Observations made at Calcutta over the period 1947–1952 are in reasonable agreement with the theory.

551.510.535 **2292**

Absence of Bifurcation in the E Layer.—J. C. Seddon & J. E. Jackson. (*Phys. Rev.,* 15th Feb. 1955, Vol. 97, No. 4, pp. 1182–1183.) Results of rocket measurements of electron concentration [see e.g. 1033 of April (Seddon et al.)] are adduced as evidence of absence of the bifurcation reported by Lien et al. (1054 of 1954).

551.510.535 **2293**

Further Remarks on Bifurcation in the E Layer.—W. Pfister, J. C. Ulwick & R. J. Marcou. (*Phys. Rev.,* 15th Feb. 1955, Vol. 97, No. 4, pp. 1183–1184.) Comment on 2292 above.

551.510.535 **2294**

Horizontal Movements of Ionization in the Equatorial F Region.—B. W. Osborne. (*J. atmos. terr. Phys.,* March 1955, Vol. 6, Nos. 2/3, pp. 117–123.) Results of measurements at Singapore during the period September 1953–April 1954 show the existence of a regular semidiurnal sinusoidal variation in the E-W velocity component at the equinoxes. Around the December solstice, during the mornings, the movements were irregular. No correlation with virtual height was found, nor any regular N-S movement.

551.510.535 **2295**

Origin of the F_1 Layer.—E. Chvojková. (*Bull. astr. Insts Csl.,* 1st Sept. 1953, Vol. 4, No. 5, pp. 101–109. In German.) The splitting of the F layer into the F_1 and F_2 layers is considered to be due to a thermal effect. The maximum temperature occurs in the region of maximum ion production, but since the density of gas in this region is a minimum, higher electron concentrations will occur above and below it. The region of maximum ionization lies in the lower half of the F layer and hence the F_1 layer will be thinner than the F_2 layer. The formula derived for the height distribution of the electron concentration shows that the thermal process could lead to splitting of an ionized layer and also explains the secondary nocturnal maximum of f_0F. The peculiarities of the equatorial layer described by Osborne (989 of 1952) are briefly discussed.

551.510.535 : 001.4 **2296**

Nomenclature and Conventions used in Analysis of Ionospheric Data.—K. Bibl, R. Busch, K. Rawer & K. Suchy. (*J. atmos. terr. Phys.,* March 1955, Vol. 6, Nos. 2/3, pp. 69–87. In French.) It is proposed to classify the layers according to their thickness. A 'critical thickness' is introduced to define the difference between normal layers, which are always thick, and abnormal thin layers, caused by transitory phenomena. The term 'critical frequency' may be used of thin layers if account is taken of the intensity of the echoes. Characteristics directly determined and those found by extrapolation should be distinguished. Revised lists of characteristic symbols and code letters are given in appendices.

551.510.535 : 523.746 **2297**

Relations between the Critical Frequency of the Ionosphere F_2 Layer at Freiburg and Solar Activity Centres during the Years 1948–1951.—P. Simon. (*C. R. Acad. Sci., Paris,* 14th March 1955, Vol. 240, No. 11, pp. 1192–1193.) Analysis is made separately for night-time and day-time observations. No significant variation of F_2-layer critical frequency was associated with the passage of those sunspots giving no r.f. radiation. On passage of sunspots giving r.f. radiation, the night-time critical frequency suffered a significant reduction, while the day-time value was not significantly affected. This night-time effect is in concordance with observations of ionospheric absorption reported by Davies & Hagg (1765 of June).

551.510.535 : 523.78 **2298**

Ionospheric Behaviour at Khartoum during the Eclipse of 25th February 1952.—C. M. Minnis. (*J. atmos. terr. Phys.,* March 1955, Vol. 6, Nos. 2/3, pp. 91–112.) Observations indicate that the E and F_1 layers behave as Chapman layers having constant effective recombination coefficients α' of $1{\cdot}5 \times 10^{-8}$ cm³ s⁻¹ and 8×10^{-9} cm³ s⁻¹ respectively, assuming a nonuniform distribution of the sources of ionizing radiation on the sun's disk. The positions and relative intensities of these sources and the frequency of the radiation are indicated. The F_2-layer records suggest the existence at the time of the eclipse of two component layers: a lower one corresponding to the normal post-sunrise F_2 layer, having a high α', and an upper one which is a later development of the lower, having a low α'. Changes in D-layer absorption confirm the asymmetrical distribution of sources of ionizing radiation. There is no evidence of an eclipse effect on E_s ionization, nor for a corpuscular eclipse in the F_2 layer.

551.510.535 : 621.317.39 **2299**

An Apparatus for recording Time Delays between Radio Fading Characteristics.—G. J. Phillips. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 124–128.) The equipment is designed for the study of ionospheric winds (1916 of 1952) and records time delays in the range 0·1 to 5 s, with an instrumental accuracy of about 0·1 s.

551.510.535 : 621.396.11.029.62 **2300**

Sporadic-E Propagation.—Gerson. (See 2409.)

551.510.535 : 621.396.6 : 621.317.7 **2301**

D.S.I.R. Ionospheric Absorption Measuring Equipment.—W. R. Piggott. (*Wireless Engr*, June 1955, Vol. 32, No. 6, pp. 164–169.) Main design features are described of pulse transmitting and receiving equipment used at Slough since 1941. Highly stable operation is essential. Pulse duration is variable between 50 μs and 500 μs; the frequency range is 1–10 Mc/s, and a peak power output of 0·5 kW is adequate for observer reception. Rhombic, delta and folded-dipole transmitting aerials have been used. The receiver is a superheterodyne with extra-high gain and dynamic range, and with provision for attenuation varying continuously up to about 160 db. Double-doublet and folded-dipole receiving aerials have been used. The display unit is a conventional c.r.o.

551.593 **2302**

Collisional Deactivation and the Night Airglow.—D. R. Bates. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 171–172.) A possible reaction of the oxygen is indicated to explain the observed spectrum of the night airglow.

551.510.53 **2303**

The Earth's Exterior Atmosphere and the Counterglow: The Counterglow as Related to Modern Geophysical Theories, with Seven Recent Russian Papers. Collected and translated by E. R. Hope. [Book Review]—Publishers: Defence Research Board, Ottawa, 2nd edn 1954, 52 pp. (*Nature, Lond.*, 26th Feb. 1955, Vol. 175, No. 4452, p. 377.) Theory based on observations suggests that a gaseous tail resembling that of a comet stretches away from the earth in the direction away from the sun. A valuable contribution to the literature of upper atmosphere research.

LOCATION AND AIDS TO NAVIGATION

621.396.663 : 621.396.933.1 **2304**

Qualitative and Quantitative Errors of an Automatic Radio Compass.—A. Troost & G. Ziehm. (*Fernmeldetech. Z.*, Feb. 1955, Vol. 8, No. 2, pp. 65–70.) Three sources of bearing errors in a typical automatic radio compass are considered: (*a*) effect of 'nondirectional' noise voltage in goniometer output, (*b*) effect of noise voltage and an error phase angle between the goniometer output voltage and the output voltage of the omnidirectional aerial, and (*c*) effect of inaccurate tuning.

621.396.933 : 551.594.6 **2305**

The Measurement of Low-Frequency Atmospheric Noise in Southern Africa.—(*ICAO Bull.*, Oct. 1954, Vol. 9, No. 8, pp. 7–8.) General account of work undertaken since 1946 for the development of radio navigational aids in South Africa. This includes the recording of atmospheric noise in aircraft and on the ground at 100 kc/s [438 of 1951 (Hogg)], and ground tests carried out by the Telecommunications Research Laboratory on Decca, radio-compass, consol and loran equipment installed at fixed sites; in these, atmospheric noise picked up by an aerial and measured on a recorder was fed to the equipment together with a signal to simulate actual operating conditions.

621.396.96 : 538.566 **2306**

Bistatic Radar Cross-Sections of Surfaces of Revolution.—K. M. Siegel, H. A. Alperin, R. R. Bonkowski, J. W. Crispin, A. L. Maffett, C. E. Schensted & I. V. Schensted. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 297–305.) The 'bistatic' cross-section σ (β) corresponds to an arrangement in which radar transmitter and receiver are separated, β being the angle subtended at the scatterer by the transmitter-receiver line. Simple geometrical configurations are considered in which the transmitter is located on the axis of symmetry of the scatterer. Formulae are derived, by considering current distribution, for scatterers of spheroidal, conical, ogive, paraboloidal, ellipsoidal and hyperboloidal form, with characteristic dimensions large compared with λ. See also 2269 above.

621.396.96.089.6 **2307**

Precision Calibrator checks Radar Beacons.—R. D. Sinish. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 150–153.) Description of portable transponder equipment which checks range accuracy within ± 5 yards.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **2308**

A Compensated Ionization Manometer for Measurement of Vacua with High Relative Accuracy.—J. W. Hiby & M. Pahl. (*Z. Naturf.*, Oct. 1954, Vol. 9a, No. 10, pp. 906–907.)

535.37 **2309**

Action of Ni and of Co on ZnS(Au) Phosphors. Displacement of the Fermi Level by Variation of the Concentration.—N. Arpiarian. (*C. R. Acad. Sci., Paris*, 21st March 1955, Vol. 240, No. 12, pp. 1333–1335.)

537.226 : 546.212 **2310**

The Dielectric Method of Studying the Adsorption of Water.—J. Le Bot & S. Le Montagner. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 163–164.) Continuation of experiments reported in 1998 of July, using various types of gel and varying water content. Comparable results were obtained.

537.226.2 **2311**

Dielectric Mixture Chart.—E. Sion. (*Electronics*, April 1955, Vol. 28, No. 4, p. 176.) Nomogram relating dielectric constants of mixtures of two dielectrics with the dielectric constants of the components and the composition of the mixture.

537.227 **2312**

X-Ray and Neutron Diffraction Study of Ferroelectric PbTiO$_3$.—G. Shirane, R. Pepinsky & B. C. Frazer. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 1179–1180.)

537.311.3 + 536.21 **2313**

Thermal and Electrical Conductivities of Solids at Low Temperatures.—G. K. White & S. B. Woods. (*Canad. J. Phys.*, Feb. 1955, Vol. 33, No. 2, pp. 58–73.) Measurements were made over the range 2°–300°K on materials for which lattice conductivity is comparable to electronic conductivity. Results are presented for some dilute Cu alloys, Be, Bi and Ge.

537.311.3 : 546.3-1 **2314**

Semiconducting Properties of some High-Resistance Metallic Alloys.—A. I. Drabkin. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 81–84.) A table is given showing the properties of various types of manganin, constantan and NWB alloys (Ag and Mn with Sb or Ni).

537.311.33 + 621.314.7 **2315**

Semiconductors and the Transistor.—E. W. Herold. (*J. Franklin Inst.*, Feb. 1955, Vol. 259, No. 2, pp. 87–106.) A general survey with 33 references.

537.311.33 **2316**

Motion of Electrons and Holes in Perturbed Periodic Fields.—J. M. Luttinger & W. Kohn. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 869–883.) "A new method of developing an 'effective-mass' equation for electrons moving in a perturbed periodic structure is discussed. This method is particularly adapted to such problems as arise in connection with impurity states and cyclotron resonance in semiconductors such as Si and Ge. The resulting theory generalizes the usual effective-mass treatment to the case where a band minimum is not at the centre of the Brillouin zone, and also to the case where the band is degenerate. The latter is particularly striking, the usual Wannier equation being replaced by a set of coupled differential equations."

537.311.33 **2317**

Scattering of Electrons by Charged Dislocations in Semiconductors.—W. T. Read, Jr. (*Phil. Mag.*, Feb. 1955, Vol. 46, No. 373, pp. 111–131.) Experiments [2124 of 1954 (Pearson et al.)] suggest that dislocations in Ge act as rows of closely spaced acceptor centres. In *n*-type material a dislocation accepts electrons and becomes a line of negative charge surrounded by a cylindrical region of fixed positive space charge. A theoretical investigation is made of drift and Hall mobilities for current flow normal to the dislocations, with a magnetic field (a) parallel to the dislocations, and (b) normal to them.

537.311.33 **2318**

Dielectric Properties of Transition Layers in Semiconductors.—B. M. Vul. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 3–10.) Formulae are derived for determining the capacitance, resistance and dielectric losses of the region in which the semiconductor changes from *n* to *p* type.

537.311.33 : 537.32 **2319**

On the Thermoelectric Properties of the Impurity Semiconductors.—E. Laurila. (*Ann. Acad. Sci. fenn.*, Ser. A, 1955, No. 178, 11 pp.) Formulae for the Seebeck, Peltier and Thomson coefficients of impurity semiconductors are derived on the basis of statistical theory of conductivity as developed by Shockley (246 of 1951). For a Ge *p-n* junction at room temperature the thermoelectric power is found to be about 2 mV/°K.

537.311.33 : 546.28 **2320**

Hyperfine Splitting of Donor States in Silicon.—W. Kohn & J. M. Luttinger. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 883–888.) Calculations are reported which support the view that spin resonances observed by Fletcher et al. (3254 of 1954 and 453 of February) are due to electrons in donor states.

537.311.33 : 546.28 : 548.0 **2321**

Lamellar Defects in Single Crystals of Silicon.—J. Franks, G. A. Geach & A. T. Churchman. (*Proc. phys. Soc.*, 1st Feb. 1955, Vol. 68, No. 422B, pp. 111–112.) "Otherwise perfect single crystals of silicon have been shown to contain lamellar defects lying on (111) and (123) planes. Similar lamellae may be introduced by plastic deformation."

537.311.33 : 546.289 **2322**

Effective Carrier Mobility in Surface Space-Charge Layers.—J. R. Schrieffer. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 641–646.) "Carriers held to a region near the surface by the potential well of a space-charge layer may have their mobility reduced by surface scattering, if the width of the well is of the order of a mean free path. An effective mobility, which may differ from the bulk mobility by as much as a factor of ten, has been obtained from a solution of the Boltzmann equation. Solutions have been carried out for two types of potential functions: (*a*) a linear potential corresponding to a constant space-charge field, and (*b*) a solution of Poisson's equation including an external bias applied normal to the surface. The results have been used to calculate changes in surface conductance of germanium with changes in surface potential and predict the 'field effect' and 'channel effect' mobilities."

537.311.33 : 546.289 **2323**

Gold as an Acceptor in Germanium.—W. C. Dunlap, Jr. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 614–629.) Measurements are reported on wafers cut from single crystals grown from a Ge melt to which Au had been added. Acceptor levels are found at 0·15 eV above the valence band and at 0·2 eV below the conduction band. At 77°K, specimens of *p*- or *n*-type, with either high or low resistivity can be obtained, depending on the amounts of other impurities present. Photoconductive response extends to a wavelength of about 8μ. Trapping phenomena are discussed. Important applications of Au-doped Ge in research are indicated.

537.311.33 : 546.289 **2324**

Properties of Germanium Doped with Cobalt.—W. W. Tyler, R. Newman & H. H. Woodbury. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 669–672.) "Measurements of the temperature dependence of electrical resistivity in *n*- and *p*-type cobalt-doped germanium crystals indicate that cobalt introduces acceptor levels in germanium at 0·31 ± 0·01 eV from the conduction band and 0·25 ± 0·01 eV from the valence band. Ionization energies deduced from infrared photoconductivity studies at 77°K are in good agreement with the values obtained from resistivity measurements. *N*-type samples show higher intrinsic photosensitivity than *p*-type samples and demonstrate quenching effects."

537.311.33 : 546.289 **2325**

Sparked Hydrogen Treatment of Germanium Surfaces.—N. Holonyak, Jr, & H. Letaw, Jr. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, p. 355.) On subjecting Ge specimens to a discharge in hydrogen at low pressure, the surface recombination velocity was greatly increased while the magnitude and decay time of voltages produced by illuminating *p-n* junctions was reduced; hole-storage effects in junctions were also reduced, without greatly impairing the reverse *I*/*V* characteristics.

537.311.33 : 546.47.86 **2326**

Diffusion of Sb and Sn in Semiconducting Compound SbZn.—B. I. Boltaks. (*C. R. Acad. Sci. U.R.S.S.*, 11th Feb. 1955, Vol. 100, No. 5, pp. 901–903. In Russian.) Report of an experimental investigation. A sharp change of slope of the log-D/(1/T) curve was observed at about 400°C; this effect is briefly discussed.

537.311.33 : 546.472.21 **2327**

Investigations on Zinc Sulphide Crystals.—J. Krumbiegel. (*Z. Naturf.*, Oct. 1954, Vol. 9a, No. 10, pp. 903–904.) Brief report of an investigation of the structure, luminescence and photoconductivity of single crystals grown from the vapour phase. Nonuniformities are observed particularly in the luminescence properties.

537.311.33 : 546.482.21 **2328**

Significance of the Electrical Contact in Investigations on CdS Single Crystals.—W. M. Buttler & W. Muscheid. (*Ann. Phys., Lpz.*, 15th Feb. 1954, Vol. 14, Nos. 3/5, pp. 215–219 & 15th Nov. 1954, Vol. 15, No. 2, pp. 82–111.) The properties of ohmic and of non-ohmic CdS photoresistors were investigated experimentally. Separate models are suggested for the metal-to-semiconductor contact in the two cases, one based on the assumption of a perfect contact, the other assuming a dependence of the contact on adsorption layers and surface states. Both models deviate from the Schottky-Mott model.

537.311.33 : 546.623.86 **2329**

Zone Melting of Aluminium Antimonide.—H. A. Schell. (*Z. Metallkde*, Jan. 1955, Vol. 46, No. 1, pp. 58–61.) Experiments on the purification of AlSb were made using Pfann's technique. The method proved satisfactory for eliminating Cu, Fe, Mg, Si, Ca and Pb, and yielded material with improved electrical properties.

537.311.33 : 546.811-17 **2330**

Measurements of Electrical Conductivity and Magnetoresistance of Gray Tin Filaments.—A. W. Ewald & E. E. Kohnke. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 607–613.) Measurements were made on filaments of pure material and of alloys containing Sb, As, In, Al or Zn prepared by the method described previously (*Phys. Rev.*, 1st July 1953, Vol. 91, No. 1, p. 244). For 99·998% pure Sn the activation energy is 0·082 eV and the conductivity at 0°C is $2\,090\ \Omega^{-1}\ \text{cm}^{-1}$. The activation energy is increased by addition of impurities. Differences in the temperature variation of conductivity produced by the different types of impurity are indicated.

537.311.33 : 548.0 **2331**

Energy Levels of a Disordered Alloy.—R. H. Parmenter. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 587–598.) A study is made of the one-electron energy levels of a disordered alloy, using perturbation theory. The method is relevant to problems of semiconductor crystals with imperfections. Some experimental verification is reported for a predicted tailing off of the density-of-states curve into a forbidden band.

537.311.33 : 621.396.822 **2332**

Current Noise in Semiconductors.—W. Baumgartner & H. U. Thoma. (*Z. angew. Math. Phys.*, 25th Jan. 1955, Vol. 6, No. 1, pp. 66–68.) The observed inverse-frequency spectral distribution of noise is explained in terms of electron trapping.

538.22 : 546.3-1-47-46-26 **2333**

The Structure and Properties of Some Ternary Alloys of Manganese, Zinc and Carbon.—R. G. Butters & H. P. Myers. (*Phil. Mag.*, Feb. 1955, Vol. 46, No. 373, pp. 132–143.) The single-phase alloys prepared have an ordered structure of the perovskite type and show spontaneous magnetization at room temperature. The observed magnetic properties are exceptional and indicate a new type of ferrimagnetic behaviour postulated by Néel (3159 of 1949) but not hitherto observed. Measured characteristics are presented.

538.221 **2334**

Possibility of the Observation of Exchange Resonance near a Ferrimagnetic Compensation Point.—R. K. Wangsness. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, p. 831.) Theory for a system containing two sublattices indicates that resonance corresponding to the upper branch of the frequency curve should occur at a wavelength of the order of 0·1 mm. The possibility of observing such resonance is improved by working near the compensation point for angular momentum.

538.221 **2335**

Observation of Exchange Resonance near a Ferrimagnetic Compensation Point.—T. R. McGuire. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 831–832.) Report of observations made under the conditions described by Wangsness (2334 above).

538.221 **2336**

Domains of Reverse Magnetization in Ferromagnetic Metals.—T. G. Nilan & W. S. Paxton. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 834–835.) Calculations made by Goodenough (470 of February) are discussed in the light of studies of powder patterns in polycrystalline grain-oriented Si steels.

538.221 **2337**

Spontaneous Magnetogalvanism and Magnetization in Irreversible Ferronickels.—A. L. Perrier & E. Ascher. (*C. R. Acad. Sci., Paris*, 7th March 1955, Vol. 240, No. 10, pp. 1066–1068.) Hall-effect and resistance measurements have been made on specimens containing about 70% Fe and 30% Ni, over a range of temperatures. Anomalies in the curves obtained are eliminated if, instead of the usual Hall e.m.f., the current component normal to the longitudinal electric field and to the magnetic field or the magnetization is considered as the primary transverse effect.

538.221 **2338**

Fundamental Processes in the Magnetization of Alnico Permanent-Magnet Alloys.—H. Fahlenbrach. (*Naturwissenschaften*, Feb. 1955, Vol. 42, No. 3, pp. 64–65.) Electron-microscope investigations of polycrystalline and single-crystal specimens of alnico-400 confirm the structural features observed by Nesbitt & Heidenreich (3456 of 1952) in heat-treated alloys.

538.221 **2339**

Dependence of Coercive Force on Thickness of Laminae of Fe-Si Alloy.—Yu. P. Burdakova & V. V. Druzhinin. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 108–111.)

538.221 : 537.311.31 : 538.632 **2340**

Band Model for Hall Effect, Magnetization, and Resistivity of Magnetic Metals.—E. M. Pugh. (*Phys. Rev.*, 1st Feb. 1955, Vol. 97, No. 3, pp. 647–654.)

538.221 : 538.652 **2341**

The [110] Magnetostriction of some Single Crystals of Iron and Silicon Iron.—E. W. Lee. (*Proc. phys. Soc.*, 1st Feb. 1955, Vol. 68, No. 422A, pp. 65–71.) The results of the previous investigation of magnetization curves (117 of 1954) are used in magnetostriction calculations. The magnetostriction is found to depend on crystal width in a manner similar to that for the magnetization curves.

539.234 : 546.23 **2342**

X-Ray Investigation of Selenium Films obtained by Evaporation in Vacuum.—D. N. Nasledov, V. A. Dorin & I. M. Dikina. (*Zh. tekh. Fiz.*, Jan. 1955, Vol.

25, No. 1, pp. 29–38.) A detailed report is presented; one of the conclusions is that the electrical conductivity of the film depends on the temperature of the base during the evaporation process.

549.514.51 : 621.93 **2343**

A Novel Type of Saw for the Economical Cutting of Quartz Crystals or Other Materials.—J. E. Thwaites & C. F. Sayers. (*P.O. elect. Engrs' J.*, Jan. 1955, Vol. 47, Part 4, pp. 233–235.)

621.3-761 **2344**

New Solution Ceramic Coatings.—K. Rose. (*Mater. & Meth.*, Feb. 1955, Vol. 41, No. 2, pp. 107–108.) Heat- and corrosion-resistant films are formed on either metal or nonmetal surfaces by spraying on an aqueous solution of metallic salts. The surface is warmed sufficiently to drive off the water, leaving a tightly bonded oxide layer. Oxides of Zr and Cr are especially satisfactory; oxides of Ti, Ce and Mg and some phosphates, silicates, oxyhalides and metals have also been applied in this way. Such films may be useful for resistors and capacitors as well as for protective coatings.

621.315.615 : 537.311.3 **2345**

A Note concerning the Conductivity of Liquid Dielectrics.—J. Hart & D. A. Simmons. (*Canad. J. Phys.*, Feb. 1955, Vol. 33, No. 2, pp. 54–57.) "Experiments are described which show that it is not permissible to ignore electrode effects in the calculation of the mobilities of ions in liquid dielectrics."

546.831 **2346**

Zirkonium—Seine Herstellung, Eigenschaften und Anwendungen in der Vacuumtechnik (Zirconium—its Production, Properties and Applications in Vacuum Technique). [Book Review]—W. Espe. Publishers: Winter'sche Verlagshandlung, Fuessen/Bayern, 1953, 174 pp. (*Electronic Engng*, May 1955, Vol. 27, No. 327, p. 232.) A comprehensive survey including tables of properties and a bibliography; of particular interest in relation to gettering technique.

MATHEMATICS

516 **2347**

Geometric Representation of the Gudermann Transformation.—R. Cazenave. (*Ann. Télécommun.*, Dec. 1954, Vol. 9, No. 12, pp. 330–333.)

517.51 **2348**

The Theory of Generalized Functions.—G. Temple. (*Proc. roy. Soc. A*, 22nd Feb. 1955, Vol. 228, No. 1173, pp. 175–190.) An introductory account of the construction and properties of generalized functions of real variables, so defined that any generalized function $f(x)$ possesses partial derivatives $D^p f(x)$ of all orders, and that if the sequence $f_n(x)$ converges to $f(x)$, then $D^p f_n(x)$ converges to $D^p f(x)$. Delta functions of Dirac are included in the theory. The representation of generalized functions by Fourier series and integrals is illustrated. Applications in vector analysis, potential theory and wave theory will be dealt with subsequently.

517.562 **2349**

Locus Diagrams of some Elementary Transcendental Functions.—H. Wahl. (*Frequenz*, Dec. 1954, Vol. 8, No. 12, pp. 372–378.) Continuation of paper abstracted in 1423 of May.

517.65 **2350**

Method of Computation for Generalized Lommel Integrals.—G. Coulmy. (*Ann. Télécommun.*, Nov. 1954, Vol. 9, No. 11, pp. 305–312.)

517.65 : 621.396.11 **2351**

A Table of a Function used in Radio-Propagation Theory.—Horner. (See 2397.)

519.241.1 : 621.372.54 **2352**

A New Method of Determining Correlation Functions of Stationary Time Series.—D. G. Lampard. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 35–41. Digest, *ibid.*, Part III, Sept. 1954, Vol. 101, No. 73, pp. 343–346.) The method is based on an expansion of the correlation function in a suitable orthonormal system. The coefficients in the expansion are simply related to the convolution integrals which arise when the given time series are applied to linear filters whose impulse responses are members of this orthonormal system. A method of measuring these coefficients is proposed. Complex filters can be built up having an impulse response of the same form as the desired correlation function. Examples are presented of filters whose impulse responses are members of a Laguerre system. A practical autocorrelator based on such a filter is described and some results obtained with it are reported.

519.241.5 **2353**

On the Averaging of Data.—S. S. Stevens. (*Science*, 28th Jan. 1955, Vol. 121, No. 3135, pp. 113–116.) A brief introductory discussion on when to use the mean, mode or median as measure of central tendency.

517 **2354**

Higher Transcendental Functions. [Book Review]—Staff of the Bateman Project. Publishers: McGraw Hill, London, 1953, Vol. 1, 302 pp., 52s., Vol. 2, 396 pp., 60s. (*Nature, Lond.*, 19th Feb. 1955, Vol. 175, No. 4451, p. 317.) The first two volumes of a series. Thousands of formulae are presented, usually with some indication of origin and often with suggestions as to methods of proof.

MEASUREMENTS AND TEST GEAR

621.3.018.41(083.74) : 621.396.11.029.45 **2355**

The Diurnal Carrier-Phase Variation of a 16-Kilocycle Transatlantic Signal.—Pierce. (See 2404.)

621.317.3 : 621.314.632 : 546.289 **2356**

Recovery-Time Measurements on Point-Contact Germanium Diodes.—T. E. Firle, M. E. McMahon & J. F. Roach. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 603–607.) Discussion indicates the importance of using standard techniques and terminology.

621.317.3.012.3 **2357**

Phase-Linearity Nomograph.—J. F. Sodaro. (*Electronics*, April 1955, Vol. 28, No. 4, p. 178.) Nomogram relating delay time, phase shift and frequency for circuits of various types.

621.317.32 : 621.385.2 **2358**

Use of Diodes for Measurement of R.M.S. Voltage with Good Independence of Waveform.—G. Bernardi. (*Ricerca sci.*, Jan. 1955, Vol. 25, No. 1, pp. 34–48.) The important feature of the measurement circuit described is the inclusion of an improved voltage divider for supplying the diodes.

621.317.329 : 621.373.413 **2359**

Measurement of the Distribution of the Electromagnetic Field in a Resonant Cavity.—A. Septier. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 108–114.) See 1853 of 1954.

621.317.335.2 **2360**

The Precise Measurement of Capacitance.—J. K. Webb & H. B. Wood. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 3–12. Digest, *ibid.*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 681–682.) The method described is designed to enable measurements to be made conveniently with a precision approaching that achieved by the National Physical Laboratory. A bridge network is used with inductively coupled ratio arms which can be switched into the form of either a comparison or a Wien bridge. By combined use of the comparison bridge with a 2:1 ratio and the Wien bridge with a 1:1 ratio the unknown capacitance in one arm can be determined in terms of the resistance in the other arm at a given frequency.

621.317.335.3.029.63/.64 **2361**

Phase and Amplitude Balance Methods for Permittivity Measurements between 4 and 50 cm.—T. J. Buchanan & E. H. Grant. (*Brit. J. appl. Phys.*, Feb. 1955, Vol. 6, No. 2, pp. 64–66.) The coaxial-line equipment described can be used to measure permittivities of liquids over a wide range of values; several alternative methods of procedure are given and two types of liquid cell are described. The apparatus is useful mainly for medium and high-loss liquids; for low-loss liquids cavity methods are preferred.

621.317.353.2 **2362**

Measurements of a Fundamental by [periodic] **Contacting without using a Fundamental Filter.**—P. K. Hermann. (*Frequenz*, Dec. 1954, Vol. 8, No. 12, pp. 379–382.) Extension of the method in which harmonics are eliminated by appropriate choice of the contacting period.

621.317.374 **2363**

Loss-Angle Standards [fixed and variable].—H. Hoyer. (*Arch. Elektrotech.*, 25th Nov. 1954, Vol. 41, No. 6, pp. 347–356.) Several types of fixed and variable capacitor-resistor loss-angle standards developed at the Physikalisch-Technische Bundesanstalt are described. The constructional details, method of use and experimental results are given. Standards for use at frequencies up to 10 kc/s are included.

621.317.374.027.3 **2364**

A Recording Loss-Angle Meter for High Voltages.—K. B. Westendorf. (*Arch. Elektrotech.*, 25th Nov. 1954, Vol. 41, No. 6, pp. 333–346.) A bridge-circuit instrument for use at voltages of the order of 10 kV at 50 c/s is described.

621.317.38.029.63 **2365**

A Note concerning Forces and Torques on Spheroidal Bodies in Cavities.—W. J. van de Lindt. (*Canad. J. Phys.*, Feb. 1955, Vol. 33, No. 2, pp. 113–117.) The method of determining microwave power from the force or torque on a ring in a cavity [1140 of 1954 (Kalra)] is modified by substitution of a metal sphere or spheroid for the ring. The forces acting on such a body are calculated from considerations of the energy in the cavity field.

621.317.411 : 621.318.134 : 621.372.413 **2366**

Circularly Polarized Cavities for Measurement of Tensor Permeabilities.—E. G. Spencer, R. C. LeCraw & F. Reggia. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 354–355.) The determination of the tensor permeability of a ferrite by introducing a small sample into a cavity and observing the resonance characteristic is facilitated by exciting the cavity with a circularly rather than a linearly polarized wave.

621.317.42 **2367**

A Probe for the Study of Magnetic Fields.—R. Birebent. (*C. R. Acad. Sci., Paris*, 7th March 1955, Vol. 240, No. 10, pp. 1064–1065.) The probe comprises a small coil fixed at one end of a tube and fed from an oscillator by leads passing through the tube, the other end of which carries a piezoelectric crystal. When the coil is exposed to a magnetic field, an alternating torsion is applied to the crystal, whose output is proportional to the field and to the coil current. Maximum sensitivity is obtained when the oscillator frequency is equal to the natural frequency of vibration of the probe, which was 1 kc/s in a particular model. The range of measurement is from a few oersteds to some thousands of oersteds.

621.317.7 : 621.3.018.75 **2368**

A Transient Pulse Width and Pulse Amplitude Meter.—F. Hart. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 192–197.) Two low-leakage capacitors are given charges proportional respectively to the amplitude and the duration of the pulse, and the voltages across the capacitors are measured with electrometer-type voltmeters before the charge leaks away. The particular instrument described was developed for observations on pulses originating from a mechanically vibrating valve.

621.317.7 : 621.385 **2369**

Circuit for the Determination of Contact Potentials and Electron Temperatures from Retarding Field Characteristics.—S. Friedman & L. N. Heynick. (*Rev. sci. Instrum.*, Jan. 1955, Vol. 26, No. 1, pp. 17–19.) The design of the circuit is based on the retarding-field equation for parallel-plane diodes; errors involved in applying it to measurements on other valves are discussed.

621.317.729.1 **2370**

Probe Impedance in the Electrolytic Tank.—J. C. Burfoot. (*Brit. J. appl. Phys.*, Feb. 1955, Vol. 6, No. 2, pp. 67–68.) The impedance is usually ascribed to capacitance or polarization effects, but in many cases the simple ionic conduction mechanism will give a useful estimate, so that the optimum size and shape may be calculated. Theoretical results are supported by measurements.

621.317.733 : 621.375.2 **2371**

A Tuned Detector-Amplifier for Power-Frequency Measurements.—W. K. Clothier & W. E. Smith. (*J. sci. Instrum.*, Feb. 1955, Vol. 32, No. 2, pp. 67–70.) A detector-amplifier for bridge measurements is tuned by means of a two-section *LC* filter, the inductors of which are varied simultaneously by d.c. in control windings on their mumetal cores. When used with suitable tuned input transformers it can detect power as low as 10^{-19} W.

621.317.75 : [621-526 + 621.372.5 **2372**

A Harmonic Response Plotter.—Z. Czajkowski. (*Electronic Engng*, May 1955, Vol. 27, No. 327, pp. 207–211.) The instrument described gives simultaneously the frequency response of a system and its first derived plot. It was designed for testing servo systems, but is useful for determining the characteristics of any network over the frequency range 0·2–104 c/s. An electromechanical analogue computer system is used incorporating six servomechanisms.

621.317.75 : [621-526 + 621.372.5 **2373**

Servo Analyzer for Wide-Range Testing.—F. E. Dickey. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 172–175.) A phase-shift oscillator covering the range 0·25–300 c/s provides a drive voltage for the servo unit under test and a variable two-phase output for analysis purposes. It may also be used to measure the characteristics of filters, etc. The output can be modulated to supply a 60- or 400-c/s suppressed-carrier a.m. signal.

621.317.75 : 621-526 **2374**

Transient Measurement of Feedback Control Systems.—F. H. Ferguson & C. H. Looney. (*Trans. Amer. Inst. elect. Engrs*, Part II, *Applications and Industry*, May 1953, Vol. 72, pp. 110–114.) Description of a transient-response indicator and recording system.

621.317.75 : 621.373.4.029.62 **2375**

Wobbulator Adaptor for Band III.—G. H. Leonard. (*Wireless World*, June 1955, Vol. 61, No. 6, pp. 283–287.) Full details are given of a circuit designed to operate with an existing band-I frequency-sweep oscillator for alignment of tuning units. Third harmonics of the 57–73-Mc/s range are derived in a tripler stage and amplified, the response of the amplifier peaking somewhat below the centre of the pass band to discriminate against fourth harmonics. An overall flat response is achieved by an a.g.c. system based on detecting any modulation at the sweep frequency, 25 c/s, in the r.f. output. Marker, attenuator and c.r.o. display systems are described.

621.317.755 **2376**

The Development and Design of Direct-Coupled Cathode-Ray Oscilloscopes for Industry and Research.—M. J. Goddard. (*J. Brit. Instn Radio Engrs*, April 1955, Vol. 15, No. 4, pp. 179–197.)

621.317.755 **2377**

Study and Realization of a Four-Beam Cathode-Ray Oscillograph for High-Voltage Operation.—J. Ollé. (*Rev. gén. Élect.*, Feb. 1955, Vol. 64, No. 2, pp. 104–108.) A fuller account of the oscillograph previously described by Fert et al. (1624 of 1954).

621.317.755 : 621.318.57 **2378**

Trigger Adapter for Transient Oscillograms.—L. Fleming. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 159–161.) An auxiliary unit operated by the transient to be displayed provides single sweep and unblanking of the c.r.o. beam. Sweep times of 2–5 ms are used.

621.317.755 : 621.385.029.6 **2379**

Velocity Spectrography of Electron Dynamics in a Traveling Field.—O. T. Purl & H. M. VonFoerster. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 351–353.) Velocity variations of electrons at a selected point along a beam are studied by means of a modification of an arrangement described by Bloom & VonFoerster (218 of January), one of the Lecher-wire deflection systems being replaced by a pair of curved deflection plates and the fluorescent screen being correspondingly offset. Use of this device for investigating the motion of electrons at the input of a travelling-wave valve is discussed.

621.317.772 **2380**

A Direct-Indicating Phase Meter.—A. van Weel. (*J. Brit. Instn Radio Engrs*, March 1955, Vol. 15, No. 3, pp. 143–152.) Description of a complete instrument based on principles discussed previously (3659 of 1953).

621.317.78.029.6 **2381**

A Microwave Microcalorimeter.—A. C. Macpherson & D. M. Kerns. (*Rev. sci. Instrum.*, Jan. 1955, Vol. 26, No. 1, pp. 27–33.) A bolometer instrument developed at the National Bureau of Standards measures microwave power accurately to within 1% at milliwatt levels. The bolometer mount assembly serves as a matched waveguide termination.

621.373.421.13 : 621.3.018.41(083.74) **2382**

A Simple Circuit for Frequency Standards employing Overtone Crystals.—E. P. Felch & J. O. Israel. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 596–603.) An oscillator circuit with frequency stable to within one part in 10^9 over periods of several hours is obtained using a single-stage class-A amplifier with Π-section feedback network and a quartz crystal operating at its fifth overtone, at 5 Mc/s [see 3481 of 1952 (Warner)]. Undesired frequencies are suppressed by connecting a resistor in parallel with the crystal.

621.385.001.4 : 531.768 **2383**

Vibration Generator for Electron Tubes.—(*Elect. J.*, 4th Feb. 1955, Vol. 154, No. 5, p. 350.) Electrodynamic apparatus developed at the National Bureau of Standards for testing subminiature valves uses a $BaTiO_3$ accelerometer capable of measuring vibration frequencies up to 20 kc/s at acceleration levels of 0·2–10 000 g.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.222-8 **2384**

Photoelectric Measurement of Weak Acoustic Birefringence.—J. Badoz. (*C. R. Acad. Sci., Paris*, 7th March 1955, Vol. 240, No. 10, pp. 1062–1064.) An ultrasonic beam modulated at low frequency is passed through a liquid, thus periodically producing birefringence. Polarized light passes through the liquid and is received by a photomultiplier, the intensity of the received light varying with the ultrasonic variations. The photomultiplier output is connected to a selective amplifier followed by a detector. Differences of optical path down to $10^{-4}\lambda$ can thus be measured.

621.316.7 **2385**

A Design Philosophy for Man-Machine Control Systems.—M. Hoberman. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, p. 623.) Comment on 822 of March (Birmingham & Taylor), suggesting that animals could replace humans as machine minders in some cases.

621.37/.38] : 786.2 **2386**

New Electronic Piano.—B. F. Miessner. (*Radio-Electronics*, Feb. 1955, Vol. 26, No. 2, pp. 64–66, 68.) Description of a keyboard instrument in which the strings are replaced by hammer-struck fixed-free reeds capacitively associated with fixed electrodes to control the frequency of an oscillator, producing a f.m. signal which is detected by a discriminator.

621.373.43 : 616-7 **2387**

Application of Pulse Circuits in Medicine.—I. Abrikosov. (*Radio, Moscow*, Dec. 1954, No. 12, pp. 43–45.) Basic circuits are shown of apparatus for diagnosis and therapy. The pulse shapes and repetition rates most commonly used are indicated.

621.383.2 : 621.317.087 : 534.213-8 **2388**

A Method of Ultrasonoscopy using an Electron-Optical Image Converter.—M. von Ardenne. (*Nachr-Tech.*, Feb. 1955, Vol. 5, No. 2, pp. 49–51.) The ultrasonic-wave intensity distribution produced by a selectively absorbing test object is converted into a corresponding temperature distribution at an absorbing layer on the image converter photocathode. For maximum sensitivity the cathode work function should be low; a suggested material is [Ag]-Cs_2O on a CsAg base, which has a work function of about 1 eV. The sketch of the suggested arrangement includes notes on materials and dimensions; the calculated threshold ultrasonic energy, when using a photographic method of recording the image, is about 0·04 W/cm². References to literature on the subject are tabulated, classified according to the method used, and the operation of the converters is outlined.

621.383.2 : 778.37 **2389**

Two New Image-Converter Tubes for Scientific Uses, 'Valvo 18120' and 'Valvo 18130'.—F. Cubasch. (*Elektronische Rundschau*, Jan. 1955, Vol. 9, No. 1, pp. 5–11.) A diode- and a triode-type image converter are described. Applications noted include use in a high-speed camera; a circuit diagram is given and results obtained are illustrated. Exposure times shorter than 10^{-7} sec are attainable. Methods of increasing the repetition rate to about 200 000 exposures/sec are mentioned.

621.384.622 **2390**

Linear-Accelerator Issue.—(*Rev. sci. Instrum.*, Feb. 1955, Vol. 26, No. 2, pp. 111–231.) Detailed accounts are included of the Berkeley accelerator, which produces 31·5-MeV protons, and of the Stanford Mark-II and Mark-III travelling-wave electron accelerators.

621.385.833 **2391**

Electron Optics of Cylindrical Systems having a Plane of Symmetry: Part 1—First-Order Approximation.—M. Laudet. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 118–124.) Expressions for the electron trajectories are derived, using Lagrange's method.

621.385.833 : 537.533 **2392**

Use of Space Charge in Electron Optics.—E. A. Ash. (*J. appl. Phys.*, March 1955, Vol. 26, No. 3, pp. 327–330.) "The electron optical properties of a cylindrical space charge cloud are derived. The possibility of achieving a system free from either spherical or chromatic aberration by combining a space charge lens with a space charge free converging lens is examined. It is concluded that the achromatization of a thin electric or magnetic lens is possible only if the resultant action of the combination is divergent. The correction of the spherical aberration of a high quality lens, such as an electron microscope objective, is shown to be impossible on account of electron interaction effects."

621.387.424 **2393**

Geometric Efficiency of Cylindrical [G-M] **Counters.**—J. Goldemberg. (*Rev. sci. Instrum.*, Jan. 1955, Vol. 26, No. 1, pp. 41–44.)

621.387.424 **2394**

Spontaneous Discharges of Thermionic Origin in Geiger Counters.—R. Meunier, M. Bonpas & J. P. Legrand. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 145–148.)

621.387.424 **2395**

Geiger Counters with Tr_2O Vapour Filling.—P. Meunier, M. Bonpas & J. P. Legrand. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 148–151.)

621.397.3 **2396**

Image Processing.—Kovásznay & Joseph. (See 2445.)

PROPAGATION OF WAVES

621.396.11 : 517.65 **2397**

A Table of a Function used in Radio-Propagation Theory.—F. Horner. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 134–137. Digest, *ibid.*, Part B, May 1955, Vol. 102, No. 3, p. 400.) "Real and imaginary components of the complex integral $1 + 2j\sqrt{(\omega)}\,\epsilon^{-\omega}\int_{-j\sqrt{\omega}}^{\infty}\epsilon^{-x^2}\,dx$ are tabulated as a function of ω. The Tables are prepared for real components of ω in the range 0 to 10, associated with imaginary components in the range −10 to 0."

621.396.11 : 537.56 **2398**

Theory of Coupling of the Ordinary and Extraordinary Electromagnetic Waves in an Inhomogeneous Anisotropic Plasma and Conditions for Reflection. Applications to the Ionosphere.—R. Jancel & T. Kahan. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 136–145.) Results of previous work [1030, 2196 and 2364 of 1954] are applied. Using the BKW approximation, expressions for the refractive index of the medium and the conditions for reflection both for longitudinal and transverse propagation are developed. Coupling is then considered, the four-sheeted Riemann surface representing the refractive-index equation giving the various forms of coupling between the ordinary and extraordinary rays. This surface is studied in detail for the particular conditions of the ionosphere.

621.396.11 : 551.510.52 **2399**

Cheyenne Mountain Tropospheric Propagation Experiments.—A. P. Barsis, J. W. Herbstreit & K. O. Hornberg. (*Nat. Bur. Stand. Circulars*, 3rd Jan. 1955, No. 554, 39 pp.) Experiments were started in 1950 on propagation over simulated air-to-ground communication paths, using c.w. transmitters on five frequencies in the range 92–1 046 Mc/s, receivers continuously recording field strength at four locations within 226 miles of the mountain with additional provision for reception at distances of 393 and 617 miles, and an extensive meteorological installation at Haswell, Colo. A detailed description is given of the transmitting and receiving equipment. Sample results lend support to Booker & Gordon's theory of scattering elaborated by Staras (804 of 1953). See also 2499 of 1954 (Bean) and *Convention Record Inst. Radio Engrs*, 1953, Part 2, pp. 85–93 (Herbstreit et al.).

621.396.11 : 551.510.535 **2400**

An Ionospheric Attenuation Equivalence Theorem.—E. V. Appleton & W. J. G. Beynon. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 141–148.) Partial reflection and scattering in the ionosphere may be important sources of attenuation of radio waves. For frequencies well above the equivalent critical frequency the following theorem relating oblique-incidence to vertical-incidence phenomena is stated:

$$\Big[\rho\Big]_{i_0}^{f} = \lambda\Big[\rho\Big]_{0}^{f\cos i_0}$$

where ρ is the fractional attenuation, f the frequency and i_0 the angle of incidence; $\lambda = 1$ or $\cos 2\,i_0$, according as the electric vector is perpendicular to the plane of propagation or in the plane.

621.396.11 : 551.510.535 **2401**

Radio Disturbance Warnings in Japan.—T. Obayashi. (*J. Radio Res. Labs, Japan*, Sept. 1954, Vol. 1, No. 6, pp. 55–61.) The system operated by the Hiraiso observatory is described. Short-term forecasts are broadcast on 4 Mc/s and 8 Mc/s from the standard-frequency station JJY. Weekly and monthly forecasts and special services for operators are provided.

621.396.11.029.45 : 551.510.535 **2402**

The Numerical Solution of Differential Equations governing Reflexion of Long Radio Waves from the Ionosphere.—K. G. Budden. (*Proc. roy. Soc. A*, 8th

Feb. 1955, Vol. 227, No. 1171, pp. 516–537.) Two methods which have been used with the EDSAC are described. "In the first method the first-order simultaneous equations, derived from Maxwell's equations and the constitutive relations for the ionosphere, are integrated by a step-by-step process proceeding downwards. The integrations are started from properly chosen initial solutions. From the resulting field variables at the bottom of the ionosphere a reflexion coefficient matrix **R** is derived, whose elements include the familiar reflexion coefficients. Two integrations are needed for each derivation of the elements of **R**. For the second method, it is shown that the formulae for **R** for a level below the ionosphere can be applied also within the ionized medium, and define a more general matrix variable whose elements are the dependent variables in a new set of differential equations. These are integrated by a step-by-step process as in the first method. The solution obtained below the ionosphere gives the required set of reflexion coefficients without further calculation. Only one integration is required for each derivation. The equations are given in full for certain important special cases."

621.396.11.029.45 : 551.510.535 **2403**

The Ionospheric Propagation of Radio Waves of Frequency 16 kc/s over Short Distances.—T. W. Straker. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 122–133. Digest, *ibid.*, Part B, May 1955, Vol. 102, No. 3, pp. 396–399.) Report of experiments made during the period March 1948–October 1949, in continuation of the investigations described by Budden et al. (*Proc. roy. Soc. A*, 19th May 1939, Vol. 171, No. 945, pp. 188–214) on signals transmitted from Rugby to Cambridge; amplitude and phase were measured separately. Conclusions reached previously concerning diurnal and seasonal variations of the reflection height are confirmed. Marked seasonal variation of the amplitude of the downcoming wave was observed, the variations being different for daytime and night-time. During summer the amplitude was closely controlled by the sun, but was not related in any simple way to the zenith angle. The sunrise effect for amplitude occurred about an hour earlier than for phase. Subsidiary variations observed are consistent with reflection taking place at two levels. Abnormal variations of reflection height occurred during and after magnetic storms.

621.396.11.029.45 : 621.3.018.41(083.74) **2404**

The Diurnal Carrier-Phase Variation of a 16-Kilocycle Transatlantic Signal.—J. A. Pierce. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 584–588.) Measurements at Cambridge, Massachusetts, on signals from GBR are reported. The diurnal variation in apparent transmission time is about 40 μs; this is presumed to be due to a variation of 10–12 km in h'. The degree of phase stability of the received signal is such as to permit intercontinental comparison of frequencies with a precision of at least 1 part in 10^{10}. On this basis, a radio navigation system could theoretically be accurate to within about a mile at a range of several thousand miles. The importance of such stability for narrow-band reception is discussed. See also 1425 of May (Pierce et al.).

621.396.11.029.6 **2405**

Tropospheric Scatter Propagation.—(*Wireless World*, June 1955, Vol. 61, No. 6, pp. 253–254.) Experiments carried out in America at frequencies in the lower u.h.f. band, using 10-kW transmitters with aerial reflectors 60 ft in diameter, show that wide-band transmissions over a range of 200 miles are feasible. The system will probably be used to supplement the present radio-link system. Other experiments in progress at Syracuse are designed to determine the best modulation system and the diurnal and seasonal variation in reception. See also 2811 of 1951 (Straiton et al.).

621.396.11.029.6 **2406**

Large Reduction of V.H.F. Transmission Loss and Fading by the Presence of a Mountain Obstacle in Beyond-Line-of-Sight Paths.—J. H. Crysdale: F. H. Dickson, J. J. Egli, J. W. Herbstreit & G. S. Wickizer. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 627–628.) Comment on 3396 of 1953 and authors' reply.

621.396.11.029.62 **2407**

V.H.F. Field Strength far beyond the Radio Horizon.—T. F. Rogers. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, p. 623.) Measurements on a 220-Mc/s pulsed signal are reported; an airborne receiver was used, at an altitude of 500 ft, at distances up to 420 miles. Differences from Megaw's results (973 of 1951) are noted. The results appear to be reasonably consistent with a d^{-7} law of variation of field strength.

621.396.11.029.62 **2408**

Meteorological Consideration on the V.H.F. Propagation between Inubo and Hiraiso.—K. Hirao & H. Maruyama. (*J. Radio Res. Labs, Japan*, Sept. 1954, Vol. 1, No. 6, pp. 31–40.) Results of propagation tests during the period June–August 1952 at 153 Mc/s over a 78-km sea path are analysed with reference to aerological data. A sudden 20-db increase of field strength lasting up to several hours occurred frequently during both baiu and summer seasons. These increases are related to meteorological conditions giving rise to dry, warm air over the sea surface.

621.396.11.029.62 : 551.510.535 **2409**

Sporadic-E Propagation.—N. C. Gerson. (*J. atmos. terr. Phys.*, March 1955, Vol. 6, Nos. 2/3, pp. 113–116.) Reports of two-way communication by amateurs during the period 1949–1952, mainly in summer, on a frequency of 50 Mc/s, are analysed. The results indicate that the modal station separation was 1 490 km, 2 800 km and about 4 200 km for single-, double- and triple-hop communication respectively. E_s clouds having an effective diameter of about 925 km appeared to be fairly prevalent.

621.396.11.029.64 : 535.4 **2410**

The Reflection of Electromagnetic Waves from a Rough Surface.—H. Davies. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, p. 148.) Discussion on 537 of February.

621.396.81.029.53 **2411**

Measurement of Loran Waves.—Y. Aono, T. Kobayashi, C. Ouchi & C. Nemoto. (*J. Radio Res. Labs, Japan*, Sept. 1954, Vol. 1, No. 6, pp. 1–16.) In order to develop a reliable system for predicting field strength in the m.f. band, measurements were made at Hiraiso of the field strength of 1·85-Mc/s and 1·95-Mc/s loran transmissions from 12 stations in the western Pacific Ocean between 200 and 4000 km away. Results are analysed and characteristic curves are derived for diurnal variation factor κ and absorption factor Γ_m. These are used in constructing nomograms (*a*) relating κ to local time, month, and latitude of transmitting and receiving stations, and (*b*) relating Γ_2 (deviative absorption factor), critical frequency, m.u.f., operating frequency and distance.

RECEPTION

621.39 : 534.78 **2412**

The Effect of Severe Amplitude Limitation on Certain Types of Random Signal: a Clue to the Intelligibility of 'Infinitely' Clipped Speech.—J. M. C. Dukes. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 88–97. Digest, *ibid.*, Part B, March 1955, Vol. 102, No. 2, pp. 261–263.) The energy spectrum of a random waveform is compared with that of the waveform after limiting and differentiation. With certain signals of common occurrence the average energy distribution is not much affected by the limiting and the phase relation between the waveforms is highly coherent. This result explains the observed high intelligibility of clipped speech [1537 of 1948 (Licklider & Pollack)].

621.396.621 + 621.37].049.75 **2413**

Investigations of Laboratory Production of Printed Circuits for Communication Equipment.—Götze. (See 2223.)

621.396.621.57 : 621.314.7 **2414**

Crystal Valve Receivers.—A. Stead. (*R. S. G. B. Bull.*, Feb. 1955, Vol. 30, No. 8, pp. 378–380.) The design of simple 'straight' receivers employing point-contact and junction-type transistors is described and complete circuit diagrams are given. The receivers worked satisfactorily at frequencies up to 2 Mc/s.

621.396.822: 621.396.62 **2415**

The Response of a Nonlinear System to Random Noise.—W. E. Thomson. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 46–48. Digest, *ibid.*, Part III, Nov. 1954, Vol. 101, No. 74, p. 407.) A simplified form is derived of a formula obtained previously [see e.g. 3238 of 1948 (Middleton)] for the autocorrelation function of the output of a nonlinear system for the case where the output/input relation is expressed as a power series. The new formula emphasizes that intermodulation products of different orders are uncorrelated while contributions to the intermodulation product of a given order from different terms of the power series are completely correlated. If the output is expressed as a series of Hermite polynomial functions of the input, each term of the series gives rise to intermodulation products of one order only.

621.396.823 **2416**

High-Frequency Interference from Electric-Fence Equipment.—M. Haag. (*Elektrotech. Z.*, *Edn A*, 1st Feb. 1955, Vol. 76, No. 3, pp. 120–124.) Electric fences considered are operated with voltage pulses of up to 5 kV, maximum pulse charge of 2·5 mA.s, pulse duration 0·1 sec and pulse intervals of at least 0·75 sec. Radio interference occurs mainly in the long-, medium- and short-wave bands; u.s.w. interference has not so far been reported. Suitable measurement circuits and suppressors are discussed and both impedance/frequency and interference/frequency curves are shown.

621.396.823 : 537.523.3 **2417**

Radio Interference from Direct-Voltage Corona in a Coaxial Cylindrical Field.—H. Heindl. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 93–98.) Report of a laboratory investigation intended as preliminary to a study of the effects produced by a.c. lines. The r.f. interference calculated from a consideration of the corona discharge mechanism is in good agreement with the observations. Comparison is made also with results obtained by other workers in various countries.

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 = 20 **2418**

Extent of Redundancy in Speech and its Importance in Long-Distance Telephony.—W. Endres. (*Fernmeldetech. Z.*, Feb. 1955, Vol. 8, No. 2, pp. 89–93.) According to communication theory, the time interval during which the frequency/time characteristic of a sound remains constant is considered to be redundant. Visible speech diagrams indicate that the redundancy in spoken English is about 50%; a 2:1 time-compression should therefore be feasible.

621.395.44 : 621.315.052.63 **2419**

Telecommunication Equipment for Power Systems: Developments and Application in Sweden.—U. Hecht, S. Rodhe & H. J. B. Nevitt. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, Oct. 1953, Vol. 72, pp. 961–968. Discussion, pp. 968–969.) See also 1148 of April (Rathsman et al.).

621.395.44 : 621.315.052.63 : 621.395.822 **2420**

A Study of Carrier-Frequency Noise on Power Lines: Part 3—Interpretation of Field Measurements.—J. D. Moynihan & B. J. Sparlin. (*Trans. Amer. Inst. elect. Engrs*, Part III, *Power Apparatus and Systems*, June 1953, Vol. 72, pp. 573–580. Discussion, pp. 580–581.) Corrections for bandwidth and impedance differences to be considered in correlating test data are discussed. A standard reference bandwidth of 1 kc/s is suggested. Parts 1 and 2: 3705 of 1953 (Cheek & Moynihan).

621.395.741 : 621.3.018.78 **2421**

Law of Addition of Distortion Voltages in Long-Distance Communication Systems.—K. Steinbuch & H. Marko. (*Fernmeldetech. Z.*, Feb. 1955, Vol. 8, No. 2, pp. 71–78.) The law of addition of interference voltages due to thermal noise and to the nonlinear distortion in the amplifiers is derived for cascaded amplifiers with given phase characteristics. With sufficiently curved characteristics arithmetical addition is partly prevented, but the maximum obtainable gain is of the order of only 1·3 N. Such a phase characteristic can be obtained by means of a suitable all-pass filter in the system.

621.396.4 : 621.376.222 **2422**

Study of the Balanced Valve Modulator for S.S.B. Radio Communication.—G. Bronzi. (*Alta Frequenza*, Dec. 1954, Vol. 23, No. 6, pp. 335–356.) Operation of conventional balanced bridge circuits is analysed. If the amplitudes of the modulation and carrier signals, the static valve characteristics and the load are known, the maximum bridge output voltage can be determined graphically. Experiments confirm the validity of the method.

621.396.65 : 621.396.41 **2423**

Trieste-Venezia-Bologna-Verona-Milano Radio-Link Network.—L. Bernardi. (*Poste e Telecomunicazioni*, Feb. 1955, Vol. 23, No. 2, pp. 61–67.) Extensions to the Mestre-Trieste multichannel microwave communication link (3109 of 1953) are described.

621.396.712.3 : 534.86 **2424**

On the Structural and Room Acoustics of the Multipurpose Studio Unit at Broadcasting House, Hamburg.—Venzke. (See 2180.)

621.396.97 + 621.397.74 **2425**

Present State of U.S.W. Sound and Television Broadcasting Coverage [in Germany].—R. Gressmann. (*Funk-Technik*, Jan. 1955, Vol. 10, No. 2, pp. 31–34.)

SUBSIDIARY APPARATUS

621-526 **2426**

Asymmetrical Servomechanisms.—J. Loeb & J. D. Lebel. (*Ann. Télécommun.*, Oct. 1954, Vol. 9, No. 10, pp. 282–286.) Servomechanisms in which the nonlinear element has an input/output characteristic asymmetric with respect to the origin are considered. Even if the input signal is a pure sine wave, the output will have a d.c. component that cannot be filtered out by the linear element. The general feedback-loop equations are reformulated and the new conditions of stability considered. A temperature-control device is treated as an example.

621-526 **2427**

Feedback Control Systems.—(*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* 1953, Vol. 72.) The following papers are included:—

- Quick Methods for evaluating the Closed-Loop Poles of Feedback Control Systems (pp. 53–68. Discussion, pp. 68–70).—G. Biernson.
- Correlation Between Frequency and Transient Responses of Feedback Control Systems (pp. 81–92). —Y. Chu.
- Coulomb Friction in Feedback Control Systems (pp. 119–123. Discussion, pp. 123–126).—V. B. Haas, Jr.
- Describing Function Method of Servomechanism Analysis applied to Most Commonly Encountered Nonlinearities (pp. 243–248).—H. D. Greif.
- Optimization of Nonlinear Control Systems by means of Nonlinear Feedbacks (pp. 262–270. Discussion, pp. 270–272).—R. S. Neiswander & R. H. MacNeal.
- A Relative Damping Criterion for Linear Systems (pp. 291–294. Discussion, pp. 294–295).—J. F. Koenig.
- Errors in Relay Servo Systems (pp. 323–328. Discussion, p. 328).—L. F. Kazda.
- Effects of Friction in an Optimum Relay Servomechanism (pp. 329–335. Discussion, pp. 335–336). —T. M. Stout.
- Backlash in a Velocity Lag Servomechanism (pp. 462–467).—N. B. Nichols.
- Determination of the Maximum Modulus, or of the Specified Gain, of a Servomechanism by Complex-Variable Differentiation (pp. 467–468. Discussion, pp. 468–469).—T. J. Higgins & C. M. Siegel.

Abstracts of other papers appear separately.

621-526 **2428**

Some Saturation Phenomena in Servomechanisms with Emphasis on the Tachometer Stabilized System.—E. Levinson. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* March 1953, Vol. 72, pp. 1–9.) Analytical methods of dealing with frequency response and transient response are described and various saturation effects are explained.

621-526 **2429**

Relative Stability of Closed-Loop Systems.—M. J. Kirby & D. C. Beaumariage. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* March 1953, Vol. 72, pp. 22–43.) The equivalence of a transfer-function plot and a plot of the Laplace transform of transient response is illustrated and the application of transform plots in the analysis of linear systems is described.

621-526 **2430**

A Differential-Analyzer Study of Certain Nonlinearly Damped Servomechanisms.—R. R. Caldwell & V. C. Rideout. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* July 1953, Vol. 72, pp. 165–169. Discussion, pp. 169–170.) Advantages of the system described by Lewis (1186 of 1954) over corresponding linear systems are illustrated and modifications to improve its operation are suggested.

621-526 **2431**

Limiting in Feedback Control Systems.—R. J. Kochenburger. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* July 1953, Vol. 72, pp. 180–192. Discussion, pp. 192–194.) Study of the effect of limiting on system performance in terms of the frequency response.

621-526 **2432**

Open-Loop Frequency Response Method for Nonlinear Servomechanisms.—R. L. Cosgriff. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* Sept. 1953, Vol. 72, pp. 222–225.) A graphical representation similar to a Nyquist diagram is developed for indicating frequency response characteristics and for the synthesis of linear filters.

621-526 **2433**

The Synthesis of "Optimum" Transient Response: Criteria and Standard Forms.—D. Graham & R. C. Lathrop. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* Nov. 1953, Vol. 72, pp. 273–286. Discussion, pp. 286–288.) "Eight mathematical criteria for optimum transient responses are critically examined, and the clear superiority of the minimum integral of time-multiplied absolute-value of error is demonstrated. The application of this criterion results in the selection of standard forms, which are presented in tables." See also 268 of January.

621-526 **2434**

Approximation of Transient Response from Frequency Response Data.—C. H. Dawson. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* Nov. 1953, Vol. 72, pp. 289–291.) A relatively short method is described involving an 18-point graphical integration which gives accurate results for linear feedback systems with a closed-loop transfer function of fifth order or below.

621-526 : 016 **2435**

Bibliography on Feedback Control.—(*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* Jan. 1954, Vol. 72, pp. 430–462.) A classified list of references up to 1952 relating to the theory and application of feedback systems. A list of relevant periodicals is also given.

621-526 : 621.3.066.6 **2436**

Control of Metal Build-up in Minimum Pressure Sensitive Contact Systems [for servomechanisms].—J. P. Dallas & T. R. Stuelpnagel. (*Trans. Amer. Inst. elect. Engrs,* Part II, *Applications and Industry,* Jan. 1954, Vol. 72, pp. 398–403.) A review of designs aimed at reducing spire-type metal transfer on contacts with gaps of 0·001–0·005 in. and operating on pressures down to 0·01 g.

621.311.6 : 621.373.4 **2437**

Highly Regulated R.F. Voltage Supply.—L. G. Sloan, R. W. Raible & M. K. Testerman. (*Electronics,* April 1955, Vol. 28, No. 4, pp. 192..200.) A r.f. output voltage of 5 V r.m.s. maximum, with low harmonic content, is obtained by using a crystal-controlled pentode oscillator at the fundamental frequency, with positive feedback. Regulation of the output is achieved by means of a negative-feedback loop incorporating a high-gain d.c. amplifier which supplies the oscillator screen-grid voltage.

621.314.63 : 546.28 **2438**

Silicon Power Rectifiers for A.C. Line Operation.—G. Rudenberg. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 146–149.) Used as half-wave rectifiers, with capacitor-input filters, typical alloy-junction units rated for 135-V maximum r.m.s. input give 150 mA output at 125°C. A typical full-wave rectifier with choke-input filter will deliver 800 mA at 125°C, or 1·5 A at room temperature. Heat-dissipating mountings are discussed.

621.314.67 : 621.372.54 **2439**

Rectifier-Filter Characteristics.—F. G. Heymann. (*Wireless Engr*, June 1955, Vol. 32, No. 6, pp. 147–154.) Approximate calculations are described for the design of half-wave rectifiers with capacitor-input filters and of full-wave rectifiers with capacitor-choke-input filters. The method gives results within about 5% of measured values.

621.316.7.012 **2440**

Determination of Frequency Characteristics of Automatic Control Systems using Mikhailov's Curves.—O. P. Demchenko. (*C. R. Acad. Sci. U.R.S.S.*, 1st Feb. 1955, Vol. 100, No. 4, pp. 693–696. In Russian.)

621.316.93 : 621.396.933 **2441**

Aircraft Protection from Thunderstorm Discharges to Antennas.—J. M. Bryant, M. M. Newman & J. D. Robb. (*Trans. Amer. Inst. elect. Engrs*, Part II, *Applications and Industry*, Sept. 1953, Vol. 72, pp. 248–252. Discussion, pp. 253–254.) See 1586 of 1954.

621.316.993.08 **2442**

The Effect of Reactive Components in the Measurement of Grounding Circuits.—L. H. Harrison. (*Trans. Amer. Inst. elect. Engrs*, Part II, *Applications and Industry*, Nov. 1953, Vol. 72, pp. 340–343. Discussion, pp. 343–345.) Discussion of results of measurements of earth resistance using a.c. in the range 30 c/s–200 kc/s, and d.c.

TELEVISION AND PHOTOTELEGRAPHY

621.397.2 : 621.397.8 **2443**

Some Typical Characteristics of Frequency-Modulated Television Transmissions.—G. Brühl. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 63–68.) Control of picture quality in the course of international television exchanges is considered. The distortion of the video signal by multiple reflections in h.f. and i.f. cables is discussed; the frequency swing is the determining factor. Methods of specifying the permissible deterioration and of measuring the relevant system transmission properties are indicated.

621.397.24 **2444**

The London–South Wales Television Link.—J. C. D. Bell. (*G.E.C. Telecommun.*, Dec. 1953, No. 18, pp. 4–13.) Simultaneous two-way transmission is provided on the 165-mile London–Wenvoe coaxial link. The overall gain/frequency characteristic is flat within ± 0·65 db and the delay/frequency characteristic is flat within ± 0·075 μs over the range 500 kc/s–3·8 Mc/s. The r.m.s. noise level is 58 db below carrier level for the London–Bristol section.

621.397.3 **2445**

Image Processing.—L. S. G. Kovásznay & H. M. Joseph. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 560–570.) Mathematical theory is presented and extensions and applications are discussed of the techniques described previously (1541 of 1954).

621.397.335.001.4 **2446**

Aligning TV Receivers by Pulse-Cross Display.—H. E. Thomas. (*Electronics*, April 1955, Vol. 28, No. 4, pp. 184..192.) Synchronization faults in a television system may be analysed by presentation on the picture tube screen of the synchronizing and blanking portions of the signal, by simple adjustment of the receiver controls. See also 1125 of 1952 (Launer).

621.397.5 **2447**

Television and Modern Information Theory.—F. Schröter. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 1–7.) See 556 of February.

621.397.5(083.7) **2448**

I.R.E. Standards on Television: Definitions of Television Signal Measurement Terms, 1955.—(*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 619–622.) Standard 55 I.R.E. 23 S1.

621.397.6 **2449**

Possible Methods of Equalization in Vestigial Sideband Transmission in Television.—H. J. Griese. (*Fernmeldetech. Z.*, Feb. 1955, Vol. 8, No. 2, pp. 94–103.) A survey with particular reference to the method of improving transient response described by Ruston (3253 of 1952). Results of an experimental investigation of transient response on two types of receiver are presented graphically and a standard television-receiver response is proposed, combined with the application of group delay pre-emphasis at the transmitter.

621.397.6 : 778.5 : 621.395.625.3 **2450**

Methods of Picture-Synchronized Sound Recording in Television.—K. E. Gondesen. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1954, Vol. 6, Nos. 11/12, pp. 237–242.) 16-mm film with magnetic sound track is preferred. The principles of the single-stripe method and three variants of the double-stripe method, (*a*) with perforated film, (*b*) with a pilot frequency and (*c*) without special synchronization, are outlined. The equipment and operation of these methods are described and applications of these and photoelectric recording techniques are tabulated. See also 1802 of June (Lauer & Schulze).

621.397.611.2 **2451**

Properties and Applications of Television Camera Tubes with Photoconductive Targets.—W. Heimann. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 13–19.) The construction and operation of vidicon-type tubes are discussed with particular reference to the development of a German tube, the resistron. A method is described for measuring the time delay of the target response in normal operation, in which a vertical bar pattern is scanned horizontally across the target. The picture quality attained is illustrated by photographs.

621.397.62 + 621.396.67 **2452**

New Television Receivers and Aerials [in Western Germany].—W. W. Diefenbach. (*Funk-Technik, Berlin*, Feb. 1955, Vol. 10. No. 4, pp. 88–91.) A brief survey of commercially available equipment.

621.397.62 : 535.88 **2453**

M.E.P. 55 Projector.—A. V. J. Martin. (*Télévision*, Feb. 1955, No. 51, pp. 45–51.) Illustrated description of a television receiver using a classical objective system for projecting pictures of linear dimensions variable from about 25 cm to 3 m. The equipment is no larger than a standard receiver with 36-cm screen.

621.397.621.2 : 535.623 **2454**

Convergence in the CBS-Colortron "205".—J. Giuffrida. (*Radio-Electronic Engng*, Feb. 1955, Vol. 24, No. 2, pp. 12–13, 27.) Accurate superposition of the three beams in the centre of the screen of this colour-television tube is achieved by using radial-deflection correcting coils or permanent magnets on all three guns and a lateral-deflection adjustment on one of them. Convergence of the beams when deflected requires further magnetic fields which vary as complex circular functions of the scanning angle. Circuit arrangements for deriving the required magnetic-field waveforms from the deflection system are indicated.

621.397.7 : 628.9 **2455**

Some Problems in Television Lighting.—W. C. Pafford. (*Wireless World*, June 1955, Vol. 61, No. 6, pp. 288–290.) Discussion of scene illumination and camera arrangements.

621.397.74 + 621.396.97 **2456**

Present State of U.S.W. Sound and Television Broadcasting Coverage [in Germany].—R. Gressmann. (*Funk-Technik*, Jan. 1955, Vol. 10, No. 2, pp. 31–34.)

TRANSMISSION

621.376.223 **2457**

Unbalance Effects in Modulators.—D. G. Tucker. (*J. Brit. Instn Radio Engrs*, April 1955, Vol. 15, No. 4, pp. 199–207.) Rectifier modulators of (*a*) shunt ('Cowan') and (*b*) ring types are considered. With type (*a*) only one balance control is needed and only one unbalance component can in general be brought to a real minimum by a particular adjustment. With type (*b*) two independent balance controls can be provided and two unbalance components can be simultaneously brought to a minimum. The effect of the signal voltage on the magnitude of unbalance components is zero in a modulator which is perfectly balanced in the absence of signal, and is noticeable only near the overload point even when initial unbalance exists.

621.396.61 : 621.3.018.78 **2458**

The Problem of Distortion in Anode-Voltage-Modulated Transmitters.—W. T. Runge. (*Telefunken Ztg*, Dec. 1954, Vol. 27, No. 106, p. 254.) Correction to paper abstracted in 262 of 1953.

621.396.61 : 621.375.2 **2459**

Progress in the Construction of Modulation Amplifiers for Anode-Modulated Broadcasting Transmitters.—H. Müller. (*Telefunken Ztg*, Dec. 1954, Vol. 27, No. 106, pp. 204–210.) Development work was aimed at reducing the amount of equipment and the power dissipation. The essential features of the present circuit arrangement are (*a*) operation of the driver valve with grid current, (*b*) d.c. negative feedback on the driver, and (*c*) a substantial reduction in the anode currents of the output valves with no signal applied. Because of the higher efficiency resulting from grid-current operation, smaller valves with lower anode voltage can be used. Measurements on amplifiers for 20-kW and 150-kW transmitters confirmed the saving in equipment and power dissipation.

VALVES AND THERMIONICS

621.314.632 : 546.289 **2460**

The Barrier Height of Point-Contact Germanium Diodes inferred from Measurements of the Voltage Dependence of Capacitance.—F. F. Roberts & J. R. Tillman. (*Proc. phys. Soc.*, 1st Feb. 1955, Vol. 68, No. 422B, pp. 113–115.) Results of measurements on several types of diode are presented graphically, using a $\log C/\log (V + \phi)$ presentation so as to give equal prominence to large and small values of the capacitance C and reverse voltage V, the constant ϕ being chosen for each unit so that the curves are nearly straight lines. The value of n, the reciprocal of the slope, is about 2 for most types and about 3 for some others; the interpretation of these values is discussed in terms of the distribution of impurities. It is inferred that for the cases where $n \simeq 2$ the barrier height for electrons approaching the semiconductor from the metal is less than or barely equal to half the forbidden energy gap for Ge. Attention is drawn to the discrepancy between this low value of barrier height and the much greater values to be inferred from measurements of injection ratio [e.g. 2536 of 1954 (Swanson)].

621.314.632 : 546.289 : 621.317.3 **2461**

Recovery Time Measurements on Point-Contact Germanium Diodes.—Firle, McMahon & Roach. (See 2356.)

621.314.7 + 537.311.33 **2462**

Semiconductors and the Transistor.—E. W. Herold. (*J. Franklin Inst.*, Feb. 1955, Vol. 259, No. 2, pp. 87–106.) A general survey with 33 references.

621.314.7 **2463**

Some Aspects of the Design of Power Transistors.—N. H. Fletcher. (*Proc. Inst. Radio Engrs*, May 1955, Vol. 43, No. 5, pp. 551–559.) Design of alloyed-junction transistors for a.f. operation with output > 1 W is considered. Special electrical problems are involved since the injected carrier density cannot be considered as a linear perturbation. Mechanical design problems relate mainly to cooling and shock resistance. The effect of reduction of emitter bias due to transverse current flow in the base region is examined. Transistors with class-A output ratings > 50 W have been obtained.

621.314.7.002.2 **2464**

The Transistor: Part 4—the Making of Transistors.—H. Yemm & J. I. Carasso. (*P.O. elect. Engrs' J.*, Jan. 1955, Vol. 47, Part 4, pp. 217–221.) Part 3: 1070 of April (Speight & Carasso).

621.314.7.012.8 **2465**

Theory of Equivalent Circuits for Junction Transistors.—Oertel. (See 2216.)

621.314.7.012.8 **2466**

The Frequency Dependence of [junction-] **Transistor Quadripole Parameters.**—Kettel & Meyer-Brötz. (See 2217.)

621.383.2 **2467**

Energy Distributions of Photoelectrons from Au and Ge in the Far Ultraviolet.—W. C. Walker & G. L. Weissler. (*Phys. Rev.*, 15th Feb. 1955, Vol. 97, No. 4, pp. 1178–1179.)

621.383.2 **2468**

Evolution and Conservation of the Photoelectric Effect of an Sb-Cs Layer deposited in Vacuum.—A. Lallemand & M. Duchesne. (*C. R. Acad. Sci., Paris*, 21st March 1955, Vol. 240, No. 12, pp. 1329–1331.) Experiments are described in which a sealed tube containing an Sb-Cs photocathode is introduced into an evacuated enclosure. After evaporating Ba on to the enclosure wall, the inner tube is broken and the time variation of the photoelectric emission is observed. Photosensitivity is retained longer by those cathodes which are richer in Cs. When the cathode is placed on a support cooled to about -55°C, the photosensitivity is not appreciably reduced after several hours, while the dark emission is considerably reduced.

621.383.27 2469

Theory of Operation of the Final Stage of a Photomultiplier.—P. Leuba. (*J. Phys. Radium*, Feb. 1955, Vol. 16, No. 2, pp. 161–162.) Under specified operating conditions, the voltage variation on the collector electrode is expressed approximately by $du/dt + u/RC = q(t)/C$, where RC is the time constant of the equivalent capacitor, and $q(t)$ the charge transferred from the penultimate electrode to the collector. When $RC/T \gg 1$, T being the period of charge transfer, operation is linear. When $RC/T < 100$, experiment shows that $q(t)$ is approximately an inverse exponential function.

621.383.4/.5 : 546.289 2470

Germanium Junction Photodiodes.—Zh. I. Alferov, B. M. Konovalenko, S. M. Ryvkin, V. M. Tuchkevich & A. I. Uvarov. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 11–17.) In the photocell proposed by Shive (2825 of 1953) the direction of the beam of light is parallel to the plane of the *n-p* junction. In the cell used in the present investigation the light beam is perpendicular to the plane of the junction and passes through a thin layer of *n-* or *p*-type Ge. Experiments were carried out to determine the voltage/current characteristics, dependence of current on intensity of illumination, distribution of sensitivity over the surface, spectral distribution of sensitivity, inertia and temperature effect.

621.383.4/.5 : 546.289 2471

Sensitivity of Germanium Photodiodes to X Rays.—B. M. Konovalenko, S. M. Ryvkin & V. M. Tuchkevich. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 18–20.) Measurements indicate that Ge photodiodes are much more sensitive to X rays than silver sulphide or selenium photocells. They also possess the advantage of a linear current/irradiation characteristic.

621.383.4/.5 : 546.289 2472

Mechanism of Operation of Germanium Photodiodes.—S. M. Ryvkin. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 21–28.) Theory of the operation of an *n-p* Ge diode as a photocell is given; the fundamental relations are established between the photo-e.m.f., short-circuit photocurrent and saturation current for the case of operation as a barrier-layer photocell. A general equation suitable for any operating conditions is also derived. Results are given of experiments made to verify the relations obtained, and the efficiency of the diodes used as barrier-layer photocells is discussed.

621.385 : 621.317.7 2473

Circuit for the Determination of Contact Potentials and Electron Temperatures from Retarding Field Characteristics.—Friedman & Heynick. (See 2369.)

621.385 : 621.396.822 2474

Fluctuations of Cathode Emission in Electron Valves.—A. Blanc-Lapierre, G. Goudet & P. Lapostolle. (*C. R. Acad. Sci., Paris*, 28th March 1955, Vol. 240, No. 13, pp. 1409–1411.) Noise due to fluctuations of electron velocity and of current density is discussed. Separate consideration is given to the cases where (*a*) electrons are emitted at regular intervals, and (*b*) electrons are emitted at irregular intervals. In case (*a*) there is no noise contribution from current fluctuation; expressions are given for the current-fluctuation contribution in case (*b*) and for the velocity-fluctuation contribution, which is twice as great in case (*b*) as in case (*a*). Values derived for the anode-current fluctuations of a space-charge-controlled diode, using the case (*a*) formula, are in good agreement with those obtained by direct calculation and in fairly good agreement with values obtained experimentally, indicating that the electron emission is regulated by the virtual cathode.

621.385.029.6 2475

Space-Charge Waves in Ion-Free Electron Beams.—J. Labus & K. Pöschl. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 39–46.) In a previous analysis by Labus (2182 of 1953) the r.f. variations of the beam boundary were neglected; on taking these into account, the theoretical results are in satisfactory agreement with measurements made at the Massachusetts Institute of Technology. See also 2807 of 1954.

621.385.029.6 2476

The Design of Travelling-Wave Output Valves for Microwave Relay Stations.—W. Klein. (*Arch. elekt. Übertragung*, Feb. 1955, Vol. 9, No. 2, pp. 55–62.) The operation of helix-type valves capable of giving outputs of the order of 5 W is discussed on the basis of the relation between gain and power level. To obtain the required output it is necessary to use electron guns providing strong beam concentration, or alternatively to use cathodes giving high current density; the requirements become more difficult to satisfy as the wavelength decreases. With high-gain valves very good matching is required between the localized attenuation section and the rest of the helix. Typical values of efficiency are 10–15%. See also 1526 of May (Klein & Friz).

621.385.029.6 : 621.317.755 2477

Velocity Spectrography of Electron Dynamics in a Traveling Field.—Purl & VonFoerster. (See 2379.)

621.385.032.2 : 537.533 2478

New Approach to the Design of Electron Guns for Cylindrical Beams with High Space Charge.—M. Müller. (*Arch. elekt. Übertragung*, Jan. 1955, Vol. 9, No. 1, pp. 20–28.) Discrepancies between the predicted and observed characteristics of guns with spherically curved electrodes (Pierce type) are studied. The influence of the anode aperture is evaluated by electrolyte-trough measurements, using specially shaped anode and control electrodes. Design details are given for simple electrode shapes and arrangements, and an indication is given of the corrections for high perveance values. Effects due to thermal velocity distribution are discussed.

621.385.032.21 2479

The Platinum-Cored Oxide-Cathode Repeater Valve.—G. H. Metson. (*P.O. elect. Engrs' J.*, Jan. 1955, Vol. 47, Part 4, pp. 208–211.) The reactions of cathodes with pure platinum and nickel cores to oxygen attack are compared. Complete recovery from heavy oxgyen contamination occurs in the case of platinum, whereas the nickel-cored cathode is completely destroyed.

621.385.032.213 2480

Deviation from the Boguslavski-Langmuir Law when a Tungsten Cathode of a Thermionic Valve is Heated by a High-Density Current Pulse.—S. V. Lebedev. (*Zh. eksp. teor. Fiz.*, Oct. 1954, Vol. 27, No. 4(10), pp. 487–500.) Experiments were made to find the cause of the abnormal increase in the anode current when a valve filament is heated by a high-density current pulse. A detailed report is presented including photographs of oscillograms recorded. The main conclusion reached is that the current increase is due to a change in the state of the tungsten, and is not related to the neutralization of the space charge by ions.

621.385.032.216 **2481**

Electron-Optical Study of Nonstationary Emission from an Oxide Cathode in Vacuum and in a Gas.—I. N. Prilezhaeva, V. V. Livshits & G. V. Spivak. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 97–107.) The emission from a pulsed cathode was studied. Electron-optical images were obtained showing the disturbances caused by sparking and cathode poisoning. Oscillograms of discharge currents corresponding to these images are also given.

621.385.032.216 **2482**

Growth of the Barium Orthosilicate Interface of Oxide-Coated Cathodes.—M. G. Harwood & N. Fry. (*Brit. J. appl. Phys.*, Feb. 1955, Vol. 6, No. 2, pp. 62–64.) The core/coating interface of oxide cathodes with Ni-alloy cores containing (*a*) 0·048% and (*b*) 0·17% Si was examined. In addition to barium orthosilicate a layer of nearly pure strontium oxide was found. Results of an investigation of the barium orthosilicate layer during heating at 765°C for up to 2000 hours indicate that the growth continues until all the available Si is used up, in case (*a*), but a limitation of the growth is apparent in case (*b*), possibly due to diffusion of Si.

621.385.832 **2483**

Optical Distortion of Magnetic Deflecting Coils.—E. Cambi. (*Alta Frequenza*, Dec. 1954, Vol. 23, No. 6, pp. 292–334.) First-order approximations are made for three distinct causes of distortion considered separately. These are (*a*) finite length and axial nonuniformity of the field, (*b*) curvature of the screen, and (*c*) transverse nonuniformity of the field. (*a*) is substantially independent of the direction of deflection, and may be partly compensated by (*b*) provided the screen is rotationally symmetric and concave. (*c*) is considered in terms of percentage of field harmonics present, i.e. in terms of design parameters of the coil. Conditions under which the geometric and third-harmonic distortion due to (*c*) can cancel out in an axial direction are established. All formulae are expressed in terms of design parameters of a c.r. tube.

621.385.832 **2484**

A Revolutionary Television Tube.—(*Radio & Telev. News*, April 1955, Vol. 53, No. 4, p. 44.) Brief description of a very-short-length picture tube comprising a phosphor screen sandwiched between glass plates. An electron beam is directed along an edge, adjacent to a row of deflection plates; by applying a control voltage to a selected deflection plate the beam is bent at right angles, remaining parallel to the plane of the screen. A second set of deflection plates is used to bend the beam so as to strike the screen normally.

621.385.832 : 535.37 **2485**

Reduction of Cathodoluminescence of ZnS:Ag by Irradiation with 16-kV Electrons.—K. H. J. Rottgardt & W. Berthold. (*Naturwissenschaften*, Feb. 1955, Vol. 42, No. 3, p. 67.) Experiments were made using ordinary 43-cm television tubes with Al-coated screens. Comparison of the results with those obtained previously for bombardment with 4-kV electrons [3420 of 1954 (Rottgardt)] confirms that the reduction of luminescence depends only on the number of incident electrons and is independent of electron energy over the range 2–16 kV.

621.385.832 : 681.142 **2486**

A Beam-Deflection Valve for use in Digital Computing Circuits.—M. W. Allen. (*Proc. Instn elect. Engrs*, Part C, March 1955, Vol. 102, No. 1, pp. 57–61. Digest, *ibid.*, Part II, Dec. 1954, Vol. 101, No. 84, pp. 682–684.) The properties required in a universal computing element are discussed in terms of the analogy with the nervous system. A description is given of a ribbon-beam-deflection valve consisting of two interconnected elements each having the desired properties; this enables binary addition and other operations of interest to be performed in a single valve with a 12-pin base.

621.387 **2487**

Restoration of Control in Ionic Apparatus.—V. I. Drozdov & A. F. Smirnov. (*Zh. tekh. Fiz.*, Jan. 1955, Vol. 25, No. 1, pp. 85–96.) The time necessary for the restoration of control in devices such as thyratrons, mercury rectifiers, etc. after the cessation of the current is considered; various definitions are discussed. An elementary theory of the restoration process is proposed and two experimental methods are described for determining the 'electric-strength'/time build-up characteristic which indicates the ability to block the anode voltage. Some experimental results are given.

621.387.032.216 **2488**

Peak Current of Oxide Cathodes in Arc Discharges.—H. J. Vogt. (*Elektrotech. Z., Edn A*, 1st March 1955, Vol. 76, No. 5, pp. 192–195.) An oscillographic pulse method for determining the permissible peak current is described. At this value of current, when the emission from the cathode just becomes nonuniform, both the anode-voltage and the emission-current c.r.o. traces show sharp 'spikes'. This condition was also observed spectroscopically. A circuit diagram of the experimental set-up is given.

MISCELLANEOUS

061.4 : [621.317.7 + 621.38 **2489**

Physical Society's Exhibition [1955].—(*Wireless World*, June 1955, Vol. 61, No. 6, pp. 271–278. Correction, *ibid.*, July 1955, Vol. 61, No. 7, p. 324.) An illustrated review of exhibits, including instruments and valves shown also at the R.E.C.M.F. exhibition (2490 below). See also *Wireless Engr*, June 1955, Vol. 32, No. 6, pp. 169–172.

061.4 : 621.396.6 **2490**

Components Exhibition.—(*Wireless World*, June 1955, Vol. 61, No. 6, pp. 258–264.) Detailed review of components and accessories at the R.E.C.M.F. exhibition held in London, April 1955. See also 2489 above.

620.19 : 621.37/.38].004.4 **2491**

Mould Growth in Electronic Apparatus.—E. Ganz & O. Wälchli. (*Bull. schweiz. elektrotech. Ver.*, 19th March 1955, Vol. 46, No. 6, pp. 233–239. In French.) The I.E.C. recommended methods for testing equipment and components for resistance to mould growths are discussed and modified test specifications are proposed based on experimental results. Spraying or painting with a suitable varnish should give adequate protection.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 + 538.566 **2492**

Note on the Propagation of Normal Modes in Inhomogeneous Media.—I. Tolstoy. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 274–277.) Analysis is presented for propagation in ducts with stratified media.

534.2 **2493**

Studies on Acoustic Radiation Pressure.—J. Awatani. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 278–286.) General expressions are derived for the acoustic radiation pressure on rigid and nonrigid surfaces. The pressure on objects in motion is treated, using moving coordinates. The case of a thin rigid disk is examined in detail, and numerical examples are given.

534.23-8 **2494**

Underwater Ultrasonic Scattering by a Radial Cylindrical Temperature Gradient.—P. E. Grant. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 287–291.)

534.232-8 : 546.431.824-31 **2495**

Electrostrictive Vibrations of Barium Titanate Tubes.—M. Federici. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 5–11.) Radial and longitudinal vibrations are discussed and the equations of the equivalent circuit are developed in terms of the tube dimensions and the density and elastic modulus of the material. Curves show the observed variation of impedance with frequency. The coupling coefficients for the two types of vibration are deduced.

534.24 : 526.956.5 **2496**

Reflection of Sound in the Ocean from a Continuous Stratum containing a Velocity Extremum.—E. O. Cook & H. S. Heaps. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 429–433.) Discussion indicates that reflection from layers of this type may be significantly higher than for a layer producing abrupt or monotonic velocity variation [3463 of 1953 (Carhart)]. Numerical results are tabulated for various types of layers, of thickness from 0 to 10 λ, producing a total velocity variation of ±5 and ±10 ft/s.

534.3 **2497**

Studies of the Science of Music.—É. de Blavette. (*Rev. sci., Paris*, May/June 1953, Vol. 91, No. 3323, pp. 163–211.)

534.32 **2498**

Note on Standard Pitch.—W. Lottermoser & H. J. von Braunmühl. (*Akust. Beihefte*, 1955, No. 1, pp. 92–97.) Orchestra leaders in Western Germany have been questioned regarding their practice in respect of standard pitch; the results indicate that a high proportion of them are not interested, but the most important conductors accept the 440-c/s standard. A method is described which has been used to record the standard pitch as rendered by some instruments and orchestras; this involves filtering the signal through a narrow-band filter, modulating a 5 440-c/s carrier, filtering out the 5 000-c/s signal and feeding it to a pen recorder; the accuracy of the method is within about ±0·25 c/s.

534.42 : 534-8 : 621.395.623.7 **2499**

Some New Data on the Demodulation in Air of Two Ultrasonic Waves of Different Frequency, at least One of which is a Stationary Wave.—S. Klein. (*Ann. Télécommun.*, Feb. 1955, Vol. 10, No. 2, pp. 26–29.) A series of experiments is described designed to verify earlier demonstrations reported by Maulois (958 of 1954). Two ionophone units arranged face to face some 10 cm apart, and with reflecting surfaces around the apertures, radiate acoustic waves at 30 and 32 kc/s, with acoustic pressure not exceeding 100 db above 2×10^{-4} dynes/cm^2. Stationary waves are detected by a hot-wire instrument; an audible 2-kc/s note is picked up by a stethoscope at intervals of half the ultrasonic wavelength between the apertures, or by using a microphone connected to a c.r.o. Tests out of range of the ultrasonic waves and the cessation of the audible signal when a thin card is placed between the sources indicate that the phenomenon is not due to the nonlinearity of the ear or of the detecting system.

534.6 **2500**

An Acoustic Intensity Meter.—S. Baker. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 269–273.) An instrument is described using a crystal microphone as a pressure transducer, a directional hot-wire anemometer as a velocity transducer and an electronic multiplier and integrator. The response can be made level to within ± 1 db over the frequency range 60–7 000 c/s, and the directional pattern is nearly circular.

534.6 : 519.272 **2501**

The Application of Correlation Techniques to Some Acoustic Measurements.—K. W. Goff. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 236–246.) Application of the correlator described in 2542 below to measurement of the transmission loss of structures, location of sound sources, etc., is discussed.

534.6 : 681.142 : 519.272 **2502**

An Analog Electronic Correlator for Acoustic Measurements.—Goff. (See 2542.)

534.61-8 **2503**

Investigation of a Probe for Ultrasonic Power.—M. Degrois. (*Ann. Télécommun.*, Jan. 1955, Vol. 10, No. 1, pp. 2–7.) A simply constructed instrument is described in which the temperature gradient in a rod of absorbent material (picein $C_{14}H_{18}O_7$) is measured by a thermocouple. The rod is secured to the end of a glass rod the other end of which is immersed in a liquid under ultrasonic excitation from a crystal. Calibration methods are described.

534.75 **2504**

Abnormal Amplitude Variation of Nonlinear Distortion by the Ear.—E. Zwicker. (*Akust. Beihefte*, 1955, No. 1, pp. 67–74.) Measurements of the quadratic and cubic distortion were made by applying compensation so as to eliminate a subjectively perceived difference tone. The difference in the amplitude variation of the effect for the two types of distortion is interpreted as indicating that the pressure response characteristic of the ear exhibits an inflection region at about ±0·1 μbar.

534.75 **2505**

Distribution of Audibility Threshold in Man.—E. Zwicker & W. Heinz. (*Akust. Beihefte*, 1955, No. 1, pp. 75–80.) Measurements were made on about 100 men and women students; results are shown graphically. The binaural threshold lies a little below the monaural for frequencies < 500 c/s; at frequencies > 500 c/s hearing at the threshold is by the two ears alternately.

534.75 **2506**

Masking by a Periodically Interrupted Noise.—I. Pollack. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 353–355.)

534.75 **2507**

Perceptibility of Flutter in Speech and Music.—F. A. Comerci. (*J. Soc. Mot. Pict. Telev. Engrs*, March 1955, Vol. 64, No. 3, pp. 117–122.) Preference tests were conducted with twelve subjects listening to pure tone, a sustained chord of eight tones, piano and orchestral music, and male speech subjected to flutter of different types and degree. Comparisons with results of objective measurements show that data obtained on pure tones can be used to predict the effect of flutter on musical programmes, and that the reading of a r.m.s. meter with a flutter-rate weighting network provides an index directly related to subjective quality.

534.78 **2508**

An Analysis of Perceptual Confusions among some English Consonants.—G. A. Miller & P. E. Nicely. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 338–352.)

534.78 **2509**

Calculations on a Model of the Vocal Tract for Vowel /i/ (Meat) and on the Larynx.—J. van den Berg. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 332–338.)

534.79 **2510**

Objective and Subjective Measurements of Loudness.—G. Quietsch. (*Akust. Beihefte*, 1955, No. 1, pp. 49–66.) Subjective measurements were made using 37 different noises, and the results compared with objective measurements made by three different methods, including in particular an eight-octave summation method. A 1 000-c/s tone was used as comparison standard. Deviations between the subjective and objective assessments are investigated. Masking in the lower octaves and subjective increase of loudness in the eighth octave can be allowed for. An objective loudness meter operating on the summation principle should have six bands, with the five upper bands of equal width on the 'mel' scale and the lowest band of greater width.

534.79 **2511**

The Apparent Reduction of Loudness: a Repeat Experiment.—S. S. Stevens, M. S. Rogers & R. J. Herrnstein. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 326–328.) Experiments by Laird et al. (*J. acoust. Soc. Amer.*, 1932, Vol. 3, pp. 393–401) on the relation between sound intensity and loudness indicated that an intensity reduction of 20 db brought the loudness to half-level; this result is at variance with results of other workers. New experiments with similar apparatus, a Type-2A audiometer, indicate that the original method may have been excessively sensitive to the level and order of presentation of the stimuli.

534.79 **2512**

On the Halving and Doubling of the Loudness of White Noise.—E. C. Poulton & S. S. Stevens. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 329–331.) "The decibel changes required to halve and to double the apparent loudness of a white noise were determined at nine sound pressure levels by 36 subjects. The subjects adjusted the level of the noise by means of an improved control—a "sone potentiometer" whose angular turn is roughly proportional to the loudness produced. An attempt was also made to measure and control some of the biasing factors that affect loudness estimations. Results: the median decibel changes required to produce a 2:1 loudness ratio ranged from 6 to 10 db, approximately."

534.84 **2513**

Interference Patterns in Reverberant Sound Fields.—R. V. Waterhouse. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 247–258.) Expressions are derived for the distribution of sound pressure, particle velocity and energy density in the interference field resulting from reflection at a plane surface large compared with λ, and for systems of mutually perpendicular reflectors. The largest departure from uniform distribution occurs in corners. The interference patterns do not vary greatly over the frequency range usually considered in room acoustics. Experimental results confirming the calculations are presented.

534.84 **2514**

Experiments for the Determination of Optimum Reverberation Time for Large Music Studios.—T. Somerville : W. Kuhl. (*Akust. Beihefte*, 1955, No. 1, pp. 99–100.) Comment on 620 of March (Kuhl), author's reply, and further comment.

534.85 **2515**

The Mechanical Input Impedance of Gramophone Pickups.—R. Kaiser. (*Akust. Beihefte*, 1955, No. 1, pp. 81–92.) The forces acting on the tip of the stylus are determined by making separate measurements of the lateral and vertical input impedance, using vibrometers specially designed for the two purposes. Results are given for several commercial pickups in the form of the locus diagram of the input impedance in the complex impedance plane.

534.85 : 621.396.677.833.2 **2516**

Parabolic Reflector for Sound Recording.—F. A. Everest. (*Tele-Tech & Electronic Ind.*, March 1955, Vol. 14, No. 3, pp. 77..123.)

621.395.61 **2517**

Microphones.—J. K. Hilliard. (*Proc. Instn Radio Engrs, Aust.*, March 1955, Vol. 16, No. 3, pp. 70–73; *Convention Record Inst. Radio Engrs*, 1954, Vol. 2, Part 6, pp. 42–44.) The properties of carbon, capacitor, moving-coil, ribbon, piezoelectric and differential microphones are outlined; a note on calibration and rating is included.

621.395.623.7 : 621.396.621 **2518**

Stereophonic Sound Receiver.—Limann. (See 2731.)

621.395.625.3 **2519**

Midget Tape Recorder.—(*Product Engng*, Feb. 1955, Vol. 26, No. 2, pp. 148–149.) By applying techniques used in the manufacture of hearing aids, a recorder has been designed weighing just over 3 lb and measuring 8½ by 3⅞ by 1⅞ in. The twin-track tape accommodates a half-hour record on each track. A 0·003-h.p. motor drives the tape at a speed of 1⅞ in./s. Output is 3 mW at 2 000 Ω, with signal/noise ratio 35 db and overall gain 70 db.

AERIALS AND TRANSMISSION LINES

621.372 + 621.396.677.75 **2520**

Azimuthal Surface Waves on Circular Cylinders.—R. S. Elliott. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 368–376.) "Solutions of Maxwell's equations are presented which satisfy the boundary conditions for corrugated and dielectric-clad circular conducting cylinders. These solutions have the physical interpretation of leaky azimuthal surface waves. Values of the complex propagation constant are given as functions of the geometry. For large cylinders the leakage is small and the transmission properties are approximately those of a trapped wave on a flat surface. A coarse experiment gives reasonable agreement with the theory. Some possible applications to transmission lines and antennas are indicated." See also 2853 of 1954.

621.372 **2521**

An Experimental Investigation of Axial Cylindrical Surface Waves supported by Capacitive Surfaces.—H. E. M. Barlow & A. E. Karbowiak. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 313–322.) A solid perspex rod was used as the waveguide, the diameter being reduced in stages to enable the transition from inductive to capacitive surface impedance to be observed. The measurements confirm the theoretical prediction [624 of 1954 (Barlow & Cullen)] that an axial cylindrical surface wave (E_{0x} mode) having a phase velocity greater than that of light can be supported by such a capacitive surface.

621.372.2 **2522**

Coupled Transmission Lines as Symmetrical Directional Couplers.—G. D. Monteath. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 383–392.) Symmetrical directional couplers produced by coupling together two similar unbalanced transmission lines by sharing a common outer conductor for part of their length have a characteristic impedance independent of frequency. Two forms are described; one, for laboratory measurements of power at frequencies up to 1 kMc/s, consists of two parallel strips enclosed in a square-section outer conductor; the other, for monitoring transmitter power, consists of two lead-covered coaxial cables grafted together. Possible uses in filters and aerial systems are also mentioned.

621.372.2.012 **2523**

Graphical Representation of the Impedance of a Loss-Free Line.—A. Ascione. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 64–84.) The relations between the methods of Smith, Carter & Hazeltine, and Deschamps are discussed.

621.372.8 **2524**

The Anisotropic Waveguide.—M. A. Gintsburg. (*Zh. tekh. Fiz.*, Feb. 1955, Vol. 25, No. 2, pp. 358–363.) A general equation of the 4th order with one unknown function is derived for propagation in a waveguide filled with an anisotropic medium. Propagation modes and the internal field are determined for the case of a rectangular waveguide. The interaction of the modes is discussed and conditions are established determining the possibility of the propagation of particular modes. A geometrical interpretation of the results is given, and reference is made to waveguides of other cross-sections.

621.372.8 : 621.372.413 **2525**

The Excitation of Circular Polarization in Microwave Cavities.—Tinkham & Strandberg. (See 2557.)

621.372.8.012.8 **2526**

Circular and Rectangular Waveguides and their Equivalent Circuits.—O. Zinke. (*Arch. Elektrotech.*, 10th Feb. 1955, Vol. 41, No. 7, pp. 364–384.) Equivalent circuits are deduced from Maxwell's equations for waveguides with TE or TM fields. The circuits comprise three reactive components whose values are independent of frequency, and one or two resistive components. The equivalence is exact in both rejection and pass bands in respect of attenuation, phase constant and characteristic impedance.

621.396.67 : 621.396.822 **2527**

Thermal [fluctuation] Radiation from a Thin Straight Aerial.—M. L. Levin & S. M. Rytov. (*Zh. tekh. Fiz.*, Feb. 1955, Vol. 25, No. 2, pp. 323–332.) On the basis of the general theory of electrical fluctuations and the theory of thin aerials, the thermal [fluctuation] radiation of a cylindrical conductor is considered. Spectral intensities are found for the densities of the energy flow and for the total radiated power. An expression is derived for the directivity diagram. The distribution of the fluctuation current along the aerial and the radiation resistance are calculated. The results are generalized to cover the case of a conductor of nonuniform cross-section.

621.396.67.012 **2528**

The Vertical Radiation Patterns of Medium-Wave Broadcasting Aerials.—H. Page & G. D. Monteath. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 279–295. Discussion, pp. 295–297.) It is common practice to use vertical aerials of height $0{\cdot}5\,\lambda - 0{\cdot}6\,\lambda$ so as to reduce the strength of the wave reflected by the ionosphere and thus increase the fading-free range. Results of experiments on small-scale and full-scale radiators indicate that, for an aerial on a flat uniform site, if the ionosphere behaved like a smooth reflector a larger service area would result from loop feeding than from base feeding; further improvement is obtainable by double feeding, the magnitude of the improvement being greater the lower the ground conductivity. The effect of earth systems is mainly to improve efficiency. Irregularity of the ground at the transmitter site causes distortion of the vertical radiation pattern, while diffuse reflection at the ionosphere produces an effect equivalent to blurring of the pattern. Computed patterns based on a semi-empirically determined current distribution are in reasonably good agreement with the experimental results.

621.396.67.018.2.011.21 **2529**

Coupling between Two Thin Straight Aerials carrying Harmonic Currents, in Any Position relative to Each Other.—F. Babin. (*Ann. Télécommun.*, Jan. 1955, Vol. 10, No. 1, pp. 8–17.) The mutual-impedance concept applied earlier (2569 of 1953) is invalid except in the case of a sinusoidal current distribution. Formulae are modified and extended by considering active and reactive power, and are applied in calculating the radiation resistance (*a*) for unattenuated progressive waves in a parallel-wire feeder, and (*b*) for a rhombic aerial, taking account of ground reflection.

621.396.67.029.62 : 624.07 **2530**

Disturbing Effects of Guys on Metre-Wave Radiation.—E. Paolini. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 33–47.) Guyed aerial towers for multichannel radiotelephony systems are discussed in relation to the cost per decibel of the input signal level. The cost is minimum when the uppermost guy attachment point is above the aerials. Measurements have been made of the radiation loss due to the guys with this arrangement. With horizontal polarization it entails no disadvantages, but with vertical polarization the resulting attenuation may not be negligible, and excessive coupling may be introduced between transmitting and receiving aerials. The effect on aerial impedance is generally not great.

621.396.674.3 : 621.372 **2531**

The Excitation of Surface Waves by a Vertical Antenna.—D. B. Brick. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 721–727.) Theory developed previously (2201 of August) is used to investigate the field of a linear aerial over a conducting ground plane with a thin dielectric coating. Experiments were made in a room with walls absorbent for e.m. radiation; polystyrene ground-plane coatings of three different thicknesses were tried, with (*a*) a polyrod and (*b*) a tapered-waveguide aerial. The results confirm that the field of a vertical aerial includes a cylindrical-surface-wave component large compared with the radiation-wave component. Measurements with partially coated surfaces indicate possibilities for directive radiators.

621.396.674.31.011.2 **2532**

Radiation Resistance of Folded Dipoles.—G. C. Corazza. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 22–32.) A general method is discussed for determining the ratio of the radiation resistance of the folded dipole to that of the corresponding simple dipole, for elements of arbitrary cross-section. The special case of elements with circular cross-section is treated.

621.396.677 **2533**

The Mechanism of Reception by Directional Antennae.—E. Istvánffy. (*Acta tech. Acad. Sci. hungaricae*, 1955, Vol. 11, Nos. 1/2, pp. 257–268. In English.) Hertz's solution of the wave equation implies that the existence of currents in conductors is always associated with radiation; this concept leads to contradictions in the case of highly directive aerials. By consideration of an elementary absorbing dipole it is shown that, under conditions of matching, an incident wave is totally absorbed, without re-radiation, if it has the same configuration as the wave which would be radiated by the dipole.

621.396.677.012.12 **2534**

Power Density Diagrams of Short-Wave Aerial Arrays.—S. Sampath. (*J. Instn Telecommun. Engrs, India*, March 1955, Vol. 1, No. 1, pp. 27–34.) A method of constructing the power-density diagram is described based on equal-directivity contours for an equivalent point-source array.

621.396.677.71 **2535**

Field Radiated by Circular Cylinders with Resonant Slots.—J. Munier. (*C. R. Acad. Sci., Paris*, 4th April 1955, Vol. 240, No. 14, pp. 1520–1522.) Formulae are derived for the field radiated by an array of narrow slots. Polar diagrams calculated from the formulae are in good agreement with diagrams determined experimentally.

621.396.677.71 **2536**

Field produced by an Arbitrary Slot on an Elliptic Cylinder.—J. R. Wait. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 458–463.) Analysis is presented based on a prescribed tangential component of the electric field in the slot. The integrals in the formal solution are evaluated approximately for the far-zone fields by the saddle-point method. On applying the solutions to the case of thin axial or transverse slots in a strip, results are obtained in agreement with experimental results reported by Gruenberg (1914 of 1953).

621.396.677.85 **2537**

Surface Matching of Dielectric Lenses.—E. M. T. Jones & S. B. Cohn. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 452–457.) Two methods of cancelling the surface reflections are described, one using a $\lambda/4$ matching layer and the other a reactive wall embedded within the dielectric. The reactive wall may comprise an inductive array of thin wires or a capacitive array of thin disks. Curves show how the reflection depends on the angles of incidence and polarization. Some measurements on arrays of obstacles in waveguides give results supporting the theory.

621.396.677.85 **2538**

Investigation of High Gain in Lattice Lenses for Centimetre Waves.—J. Moussiegt. (*Ann. Télécommun.*, Jan. 1955, Vol. 10, No. 1, pp. 19–24.) The design of a lattice-type lens (1595 of 1953 and back references) is discussed, in particular the location of the metal strips, the lens thickness and the number of strips in a given volume. With an experimental model of overall thickness 31·1 cm operating at a wavelength of 3·16 cm and comprising 2 213 Al strips 16 mm × 4 mm × 0·05 mm strung on nylon threads 16 mm apart, half-power beam widths were 2·75° and 3·8° in the horizontal and vertical planes respectively, and gain 34 db. An efficient lens can be designed with strips in only three nodal planes, the lens thickness being only about one wavelength.

621.396.677.85 **2539**

The Design of a Zoned Dielectric Lens for Wide-Angle Scanning.—D. H. Shinn. (*Marconi Rev.*, 2nd Quarter 1955, Vol. 18, No. 117, pp. 37–47.) Details are given of a lens whose performance was described earlier by Cheston & Shinn (731 of 1953).

AUTOMATIC COMPUTERS

681.142 **2540**

Gating Multipliers.—M. Lilamand. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 142–150.) Analogue computing equipment on lines proposed by Goldberg (151 of 1953) is described. Economy of materials is achieved by careful design of the switching circuit and by neutralization of the parasitic capacitances of the valves. An accuracy to within one part in 1 000 at a mean gating frequency of 1·5 kc/s is obtained.

681.142 **2541**

A Simplified Method for the Design of Logical Conversion Matrices.—M. L. Klein. (*Electronic Engng*, June 1955, Vol. 27, No. 328, pp. 270–272.) Diode matrix networks are discussed. A numerographical method is explained for converting from one numbering system to another. Possible applications for programming sequence control are suggested.

681.142 : 519.272 : 534.6 **2542**

An Analog Electronic Correlator for Acoustic Measurements.—K. W. Goff. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 223–236.) The correlator described is of the class operating directly on the input signals, i.e. using no carrier. The magnetic-drum time-delay system described in 322 of 1954 is used.

681.142 : 621.383 **2543**

Photoelectric Reader feeds Business Machines.—D. H. Shepard & C. C. Heasly, Jr. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 134–138.) Ordinary print is scanned by a photocell, and the resulting signals are coded and recorded on punched cards or tape, for input to computers.

681.142 : 621.395.625.3 **2544**

Magnetic Recording applied to [digital] **Computers.**—F. H. Raymond. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 89–96.) The basic considerations involved in the design of the magnetic storage drum used in the C.U.B.A. machine are discussed. Optimum dimensions of pole faces for recording and reproducing heads are calculated and design curves are given.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.066.6 **2545**

Contact Metals and Relay Contacts—Properties and Comparative Investigations.—T. Gerber. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st March 1955, Vol. 33, No. 3, pp. 89–114. In German.) A detailed experimental investigation is reported of the relation between contact resistance and the changes occurring at the contact surfaces. Current-carrying, current-free and sparking contacts are discussed. Photographs are shown of contacts of various metals after service.

621.318.4 **2546**

Optimum Shape Coils.—L. Lewin. (*Wireless Engr*, July 1955, Vol. 32, No. 7, pp. 177–178.) Analysis is presented for designing a coil to produce a required field at the centre of a cylinder, with a minimum expenditure of power.

621.318.423.013 **2547**

Calculation of Magnetic Field Strength in Cylindrical Coils.—F. H. Schückher. (*Arch. Elektrotech.*, 10th Feb. 1955, Vol. 41, No. 7, pp. 400–413.) Expressions are derived for the axial component of the magnetic field using the fact that the field strength at a given point is proportional to the difference of the solid angles subtended by the end faces of the coil. The expression for the solid angles is obtained in the form of a difference of two double series; this can easily be evaluated approximately. Tables and graphs are given together with numerical examples illustrating the method. The case of a multilayer coil is included.

621.318.5 **2548**

Parallel-Ferroresonant Feedback-Type Trigger Circuit.—J. G. Santesmases & M. R. Vidal. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 165–173.) A self-excited circuit consisting of an a.c. winding on a ferromagnetic core, shunted by a capacitance, with auxiliary windings for excitation and polarization, may be adjusted to present two, and in certain conditions three, stable states. Curves are given showing the influence of the various parameters.

621.318.57 **2549**

A Design Method for Direct-Coupled Flip-Flops.—W. Renwick & M. Phister. (*Electronic Engng*, June 1955, Vol. 27, No. 328, pp. 246–250.) Design procedure is described securing independence of valve characteristics and achieving stability with resistors and supply voltages which may vary by given percentages from the nominal values. Switching speed for given stability is a function of the supply voltages.

621.318.57 : 621.387 **2550**

Reversible Dekatron Counters.—L. C. Branson. (*Electronic Engng*, June 1955, Vol. 27, No. 328, pp. 266–268.) Bidirectional coupling in multistage counters is achieved without the use of gating circuits by providing the dekatrons with separate terminals for the two transfer electrodes between the ninth and zero cathodes.

621.319.4 : 537.311.33 **2551**

The Charging and Discharging of Nonlinear Capacitors.—J. R. Macdonald & M. K. Brachman. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, p. 741.) Correction to paper abstracted in 958 of April.

621.372 **2552**

Bounds Existing on the Time and Frequency Responses of Various Types of Networks.—A. H. Zemanian. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, p. 738.) Correction to paper abstracted in 2331 of 1954.

621.372 : 512.8/.9 **2553**

Tensor Analysis and Linear Network Theory.—R. Braae. (*Trans. S. Afr. Inst. elect. Engrs*, March 1955, Vol. 46, Part 3, pp. 67–87. Discussion, pp. 87–95.)

621.372 : 534.2-8 **2554**

Transducer Design for Ultrasonic Delay Lines.—H. J. McSkimin. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 302–309.) The suitability of quartz and $BaTiO_3$ transducers is considered for use in conjunction with $\lambda/2$ and $\lambda/4$ bonds between transducer and delay medium to widen the pass band. A relative bandwidth of 46% can theoretically be obtained using a transducer composed of $BaTiO_3$ with 12% $PbTiO_3$ and 8% $CaTiO_3$ with a $\lambda/2$ bond to a fused-silica delay line. Using quartz transducers, a relative bandwidth of 20%

was obtained experimentally with a $\lambda/2$ plastic bond, and of 85% with a $\lambda/4$ solder bond. Theory based on equivalent circuits is given.

621.372.029.6 **2555**

The Ultra-bandwidth Finline Coupler.—S. D. Robertson. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 739–741.) "The finline coupler is a recently developed microwave circuit element with which it has been possible to assemble hybrid junctions, directional couplers, and polarization-selective couplers capable of operating over bandwidths of at least three to one in frequency. Constructional details and experimental results are given."

621.372.413 **2556**

Effect of Surface Roughness on Losses in Microwave Resonant Cavities.—U. Pellegrini. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 12–21.) Measurements of Q value were made on a cylindrical TE_{011}-mode cavity specially designed so that the internal surface could be treated in various ways, e.g. by plating or polishing. The magnitude of the discrepancies between the measured values and those calculated for a perfectly smooth surface depends on the dimensions of the surface irregularities and is very small when the surface unevenness is no greater than the skin depth.

621.372.413 : 621.372.8 **2557**

The Excitation of Circular Polarization in Microwave Cavities.—M. Tinkham & M. W. P. Strandberg. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 734–738.) A matrix method is used to study the effect of transition pieces and differential phase shifters on waves propagating in guides with two degenerate orthogonal modes. Three different methods are discussed for generating circularly polarized waves in a cavity coupled to the side wall of a guide; the preferred arrangement uses a square guide with incident wave polarized along one transverse diagonal and reflected wave polarized along the other, and a circular coupling window centred in the width of one wall at an appropriate distance from the reflecting end.

621.372.5 **2558**

An Approximate Graphical-Analytical Method for plotting the Frequency Characteristics of a Linear System from its Transient Characteristic.—D. D. Klovski. (*Zh. tekh. Fiz.*, Feb. 1955, Vol. 25, No. 2, pp. 333–338.) The method proposed is based on the approximation of the area under the given curve by a sum of triangles. It is of importance in the design of automatic regulation systems.

621.372.5 **2559**

Transient Response Calculation: Approximate Method for Minimum-Phase-Shift Networks.—D. G. Sarma. (*Wireless Engr*, July 1955, Vol. 32, No. 7, pp. 179–186.) "The well-known method of linear segments for the calculation of zero-pole locations of the transfer function corresponding to a given attenuation characteristic is extended by allowing the zeros and the poles to assume complex instead of only real values."

621.372.5 : 512.831 **2560**

Matrix Algebra.—J. J. Karakash. (*Wireless Engr*, July 1955, Vol. 32, No. 7, pp. 190–195.) As a sequel to the quadripole theory presented by Cutteridge (1264 of 1953), special procedures and applications involving the general parameter matrix of passive quadripoles with bilateral circuit elements are discussed.

621.372.5 : 621.317.729 **2561**

Electrolyte Tank for solving Network Problems.—Met. (See 2702.)

621.372.5.018.7 **2562**

Synthesis of a Network for a Prescribed Time Function.—N. B. Chakrabarty. (*Indian J. Phys.*, Oct. 1954, Vol. 28, No. 10, pp. 473–484.) The moment-generating-function method and the time-series method are discussed; they yield physically realizable networks under general conditions. Three particular types of response are considered as illustrations.

621.372.54 **2563**

Design of Low-Pass Ladder Networks to work between Unequal Resistances.—E. Green. (*Marconi Rev.*, 1st Quarter 1955, Vol. 18, No. 116, pp. 21–28.) Discussion of conversion data to enable formulae established in an earlier paper (1267 of 1953) to be used for cases of unequal terminating resistances. Curves are presented relating the ratio of input and output branch resistances to the ratio of input and output decrement, for up to five branches. See also 370 of February.

621.372.54.029.6 **2564**

Band-Pass Filters using Strip-Line Techniques.—E. H. Bradley & D. R. J. White. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 152–155.) Practical details are given of materials and dimensions for u.h.f. filters and for matching them to coaxial lines. Typical units have mid-band insertion loss < 1 db, with attenuation > 40 db at 12% off mid-band frequency.

621.372.543.2 **2565**

Tchebycheff-Type Band-Pass Filters with Arbitrary Number of Circuits.—E. Henze. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 131–139.) Extension of the method developed by Dishal (3369 of 1949). Undercoupled as well as critically and overcoupled circuits are dealt with.

621.372.543.2.029.6 **2566**

Coaxial Resonator Filters.—R. F. Brown. (*A.W.A. tech. Rev.*, Feb. 1955, Vol. 9, No. 5, pp. 293–318.) From an analysis of an equivalent band-pass circuit, an expression is derived for insertion loss in terms of the loaded and unloaded Q factors, and the electrical design parameters are related to the dimensions of the resonator and the coupling loops. The insertion-loss characteristic of n identical resonators in tandem is determined by considering shunt susceptances equally spaced along a transmission line. An alignment procedure and arrangements for frequency multiplexing are described.

621.372.543.2.029.6 : 621.372.2 **2567**

Microstrip applied to Band-Pass Microwave Filters.—M. Arditi & J. Elefant. (*Elect. Commun.*, March 1955, Vol. 32, No. 1, pp. 52–61.) Impedance measurements are made by connecting the microstrip line through a network to a waveguide or a coaxial slotted line. Characteristics deduced are: (*a*) phase velocity is constant over a wide range of frequencies; (*b*) wavelength in microstrip is greater than the value corresponding to a transverse e.m. mode between infinite parallel plates, approaching this value asymptotically for very wide strips; (*c*) the dominant mode propagated is not a pure transverse e.m. mode; the characteristic impedance of a microstrip line is approximately equal to the reciprocal of the product of capacitance per unit length and phase velocity. The design of resonant sections by placing obstacles such as posts at proper distances is discussed in detail.

621.372.57 **2568**

Theory of Noisy Quadripoles.—H. Rothe & W. Dahlke. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 117–121.) Analysis is based on equivalent circuits in which the original quadripole is depicted as noise-free, all noise sources being transferred to a separate noise quadripole connected in front of it. The noise figure is found from the equivalent noise resistance, the equivalent noise conductance and a complex correlation admittance. Methods for the experimental determination of the elements of the noise quadripole are outlined. See also *Trans. Inst. Radio Engrs*, Dec. 1954, Vol. ED-1, No. 4, pp. 258–259.

621.373 **2569**

On Asynchronous Action.—N. Minorsky. (*J. Franklin Inst.*, March 1955, Vol. 259, No. 3, pp. 209–219.) An analysis is made of quenching and excitation of oscillations by an external oscillation of unrelated frequency. The excitation depends only on the transfer of the position of equilibrium across the bifurcation point in the stability diagram, and is hence observed only in 'hard' systems, whereas quenching can occur in 'hard' and in 'soft' systems.

621.373.4 : 621.375.232.3 **2570**

Cathode-Follower-Coupled Phase-Shift Oscillator.—L. Fleming. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, p. 754.) Comment on 1291 of May (Reich).

621.373.421.012 **2571**

A Graphical Sinusoidal Analysis of a Nonlinear *RC* Phase-Shift Feedback Circuit.—D. Barbiere. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 679–684.) Frequency response curves are discussed of a.f. oscillator circuits including nonlinear, e.g. thyrite, resistors in the feedback loop; over a part of the frequency range the voltage function is triple-valued. The method used involves the graphical superposition of the voltage/resistance characteristic of the nonlinear resistor on that of the parallel circuit.

621.375.13 **2572**

The Realization of a Given Transfer Coefficient: Feedback Amplifier Systems.—F. H. Raymond. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 105–112.) The design of feedback amplifiers using *RC* networks is discussed in general terms and in relation to analogue computers, low-frequency filters, servomechanisms, etc.

621.375.225 : 621.376.3.018.78 **2573**

Harmonic Distortion in Sinusoidal Frequency Modulation. Case of an Amplifier Stage comprising Pentode Valve and Tuned Transformer.—L. Robin. (*C. R. Acad. Sci., Paris*, 4th April 1955, Vol. 240, No. 14, pp. 1518–1520.) Formulae are presented for calculating the harmonics and the total distortion present in the demodulated voltage. Numerical calculations are performed for five different sets of values of two important circuit parameters.

621.375.23 **2574**

Electrical Integration Methods.—H. Wittke. (*Frequenz*, Feb. 1955, Vol. 9, No. 2, pp. 49–57.) Following brief theoretical discussions of the *RC*, Miller, and Wiegand-Hansen (772 of 1949) integrators, a new quasi-exact integrator circuit is described and both an approximate and an exact theory are given. The errors inherent in the various methods are discussed and graphs for their estimation are given.

621.375.3 **2575**

Design of Choke Magnetic Amplifiers with Complex Load.—N. P. Vasileva & O. A. Sedykh. (*Avtomatika i Telemekhanika*, Jan./Feb. 1955, Vol. 16, No. 1, pp. 47–63.) The design of transductors is considered from the practical point of view. The characteristic curves of four core materials of Russian origin are given. To illustrate the method, the design of a transductor with an amplification factor of 20, working into a 50-W load, is worked out in full.

621.375.4 : 538.632 : 546.682.86 **2576**

An Amplifier based on the Hall Effect.—I. M. Ross & N. A. C. Thompson. (*Nature, Lond.*, 19th March 1955, Vol. 175, No. 4455, p. 518.) The d.c. or a.c. signal is fed to a suitably matched coil wound on a laminated magnetic core having a narrow gap into which is inserted a thin rectangular slice of single-crystal InSb. D.c. is passed through the slice, and the Hall e.m.f. is picked up and applied to a matched load. High values of power gain are theoretically possible. An upper frequency limit is set by core losses. For comment by H. M. Barlow and authors' reply, see *ibid.*, 4th June 1955, Vol. 175, No. 4466, p. 1004.

621.375.4 : 621.314.7 **2577**

Feedback-Stabilized Transistor Amplifier.—D. W. Slaughter. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 174–175.) Loading of the feedback network is avoided by the use of an emitter-coupled differential amplifier in the first stage. A three-stage amplifier using Ge transistors gives an overall gain of 10 independent of the transistors used; Si junction transistors give more stable operation at high ambient temperatures. Circuits and component values for typical amplifiers are given.

621.376.223.018.78 **2578**

Cubic Distortions in Ring Modulators.—L. Christiansen. (*Elect. Commun.*, March 1955, Vol. 32, No. 1, pp. 43–51.) Translation of paper abstracted in 1874 of 1952.

621.376.4.029.64 : 621.387 **2579**

An Electronic Phase-Shift Tube for Microwave Frequencies.—D. H. Pringle. (*J. sci. Instrum.*, April 1955, Vol. 32, No. 4, pp. 125–127.) "The transmission of microwave radiation through an electron gas supported by a gas discharge plasma situated in a waveguide structure is discussed for the case in which the electron collision frequency is much less than the microwave frequency, and an expression is derived for the phase shift arising from the change in guide wavelength. A gas discharge phase-shift tube has been developed on this principle and efficient action obtained by using the negative glow region of the discharge. The performance of the tube is discussed in detail." See also 1289 of May (Bradley & Pringle).

GENERAL PHYSICS

536.7 : 621.396.822 **2580**

Electrical Fluctuations and Thermal Radiation.—S. M. Rytov. (*Uspekhi fiz. Nauk*, March 1955, Vol. 55, No. 3, pp. 299–314.) Text of a lecture giving a broad nonmathematical review of theoretical work on thermal fluctuations (noise) with particular reference to the u.h.f. region.

537/538 **2581**

Fundamental Electromagnetic Quantities.—P. de Belatini. (*Bull. tech. Univ. Istanbul*, 1953, Vol. 6, pp. 11–28. In German.) Anomalies involved in the generally accepted dual system of electric and magnetic quantities are discussed. A threefold system comprising magnetism, conduction electricity and dielectric electricity is proposed as an improved basis.

537 **2582**

Study of some Problems of Electrostatics.—H. Bonifas. (*Rev. gén. Élect.*, March 1955, Vol. 64, No. 3, pp. 149–158.) Elementary electrostatic phenomena are deduced from the simple electronic theory of metals; the phenomena of conduction in homogeneous metals and from metal to metal, contact potentials and the Peltier effect, are examined. The treatment is essentially nonmathematical.

537/538 (439.1) **2583**

Survey of Researches in Physics in Hungary: Part 1.—L. Jánossy. (*Nuovo Cim.*, 1955, Vol. 1, Supplement, No. 4, pp. 247–272. In English.) Short surveys by different authors are given on several subjects, including research on ferromagnetics, magnetic moments of atomic nuclei, and the force on polarized media.

537.226 **2584**

Extension of Fröhlich's General Theory of the Static Dielectric Constant to Dielectrically Anisotropic Materials.—J. G. Powles. (*Trans. Faraday Soc.*, March 1955, Vol. 51, Part 3, pp. 377–382.)

537.228.1 **2585**

Applications of the Piezoelectric Equations of State.—R. Bechmann. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 122–130.) Application of the general linear piezoelectric equations of state (110 of 1954) to plates and thin bars. Particular stress and strain systems are considered. A uniform notation is introduced for the elastic and piezoelectric constants used. The relation between dielectric constant at constant stress and at constant strain is investigated. Electromechanical coupling factor is discussed.

537.311.5 **2586**

The Resistance of an Elliptic Plate.—E. E. Jones. (*Brit. J. appl. Phys.*, March 1955, Vol. 6, No. 3, pp. 88–90.) Formulae for the resistance are derived in the form of infinite series, capable of numerical evaluation to any degree of approximation, for two different electrode arrangements.

537.52 **2587**

Dependence of the Electric Strengths of Liquids on Electrode Spacing.—A. H. Sharbaugh, J. K. Bragg & R. W. Crowe. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 434–437.) Measurements have been made on hexane, heptane and tetradecane, using electrode spacings of 2–200 μ. The electric strengths are found to vary inversely with the logarithm of the separation, as predicted by theory.

537.52 **2588**

Constriction of the Positive Column of a Glow Discharge at High Pressure.—R. G. Fowler. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 130–136.)

537.52 **2589**

The Growth of Electrodeless Discharges in Hydrogen.—G. Francis. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 137–147.)

537.525 **2590**

Electrical Breakdown at Very Low Gas Pressures.—J. W. Leech. (*Brit. J. appl. Phys.*, March 1955, Vol. 6, No. 3, pp. 107–109.) A discussion, in terms of atomic collision data, of problems involved in the interpretation of an observed anomaly in the variation of breakdown strength with pressure and in the estimation of the pressure at which breakdown would occur if it were due solely to ionizing collisions in the body of the gas.

537.525.5 : 621.385.132 **2591**

Studies of Externally Heated Hot-Cathode Arcs: Part 3—Plasma Density Distributions in the Anode-Glow Mode.—E. O. Johnson & W. M. Webster. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 82–108.) Analysis of the plasma density distributions indicates that the anode-glow mode can exist only if the emission capacity of the cathode is at least twice as great as the anode current. This is supported by experimental evidence. Part 2: **3068 of 1952 (Webster et al.).**

537.533 **2592**

Experimental Investigations on Electron Interaction.—E. A. Ash & D. Gabor. (*Proc. roy. Soc. A*, 22nd March 1955, Vol. 228, No. 1175, pp. 477–490.) Certain observations in low-pressure gas discharges and in magnetrons suggest an electron interaction effect several orders of magnitude in excess of the theoretical values based on binary encounters only. The validity of the theory was tested by experiments in which a carefully collimated electron beam was shot through a charge cloud, the scattering of the beam being directly observed. Both plasmas in thermal equilibrium and pure electronic space charges were investigated. In both cases the degree of scattering observed is less than five times the value predicted by theories neglecting simultaneous multiple collisions, hence the latter cannot account for the observed anomalies.

537.533.8 **2593**

On the Measurement of the Average Time Delay in Secondary Emission.—M. H. Greenblatt. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 52–64.) The time delay of the secondary emission is measured by comparing the duration of short bursts of primary emission with the duration of the corresponding bursts of secondary emission. The primary bursts are produced by deflecting a beam across an aperture at high speed, while the secondary beam is scanned over e.g. a fluorescent screen. The duration of the secondary pulses is longer than that of the primaries by an amount which depends on the accelerating voltage.

537.562 : 538.566 **2594**

Fundamental Wave Functions in an Unbounded Magneto-hydrodynamic Field: Part 1—General Theory.—A. Baños, Jr. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1435–1443.)

537.562 : 538.6 **2595**

Particle Transport, Electric Currents, and Pressure Balance in a Magnetically Immobilized Plasma.—L. Tonks. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1443–1445.) "An analysis of a plasma immobilized by a magnetic field shows that each kind of charged particle has a general drift perpendicular to the gradient of the field, but that there is no corresponding electric current density. There is an exact cancellation arising from the gradient of the Larmor radius. The current density which is present arises exclusively from the particle density gradient and is not associated with any drift of matter."

538.11 **2596**

Antiferromagnetism.—T. Nagamiya, K. Yosida & R. Kubo. (*Advances Phys.*, Jan. 1955, Vol. 4, No. 13, pp. 1–112.) A survey of theoretical and experimental aspects. The spin-wave approximation is useful, especially for lattices of higher dimensions and for larger magnitudes of spin. This method can be easily generalized, e.g. so as to take second-neighbour interactions and dipole forces into account. Great mathematical difficulties are involved in the refinement of the theory to apply to higher temperatures and the calculation of higher-order quantities such as the fluctuations or the short-range order. Over 100 references. See also 2920 of 1954 (Lidiard).

538.22 **2597**

Statistical Models of Ferrimagnetism.—I. Syozi & H. Nakano. (*Progr. theor. Phys.*, Jan. 1955, Vol. 13, No. 1, pp. 69–78.) A theoretical discussion of the properties of some idealized ferrimagnetic crystals, the lattice being considered divided into two sublattices.

538.3 **2598**

A Short Modern Review of Fundamental Electromagnetic Theory.—P. Hammond. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 298–300.) Further discussion on 97 of January.

538.566 : 535.4 **2599**

Diffraction of Electromagnetic Waves by a Metallic Wedge of Acute Dihedral Angle.—W. W. Grannemann & R. B. Watson. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 392–393.) An investigation is made of the field produced by reflections within the space included between two plane conductors set at an angle $\ngtr$ 90°. Experimental and theoretical results are given for angles of 90° and 30°. Discussion indicates that the field pattern for angles which are integral fractions of π can be computed on the basis of geometrical optics.

538.566 : 535.42 **2600**

The Diffraction of a Non-monochromatic Electromagnetic Wave by a Slit and a Grating.—M. H. N. Potok. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 171–176.) A general solution is derived from Kirchhoff's solution. Results of calculations and measurements are in good agreement over the range in which Kirchhoff's solution is applicable.

538.566 : 621.396.96 **2601**

Elliptically and Circularly Polarized Electromagnetic Waves.—M. Bouix. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 126–136.) A general discussion of the subject and its applications in radar technique, with extensive bibliography. See also 2199 of August.

538.569.4 **2602**

Absorption of 3·18-cm Microwaves in some Aromatic and Aliphatic Compounds in the Liquid State.—D. K. Ghosh. (*Indian J. Phys.*, Oct. 1954, Vol. 28, No. 10, pp. 485–489.)

538.569.4 : 535.33 **2603**

Microwave Spectroscopy of Gases.—J. Sheridan. (*Research, Lond.*, March 1955, Vol. 8, No. 3, pp. 88–93.) Recent developments in the field are outlined; measurements have been made at wavelengths down to <1 mm. About 80 references.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **2604**

Distribution of Radio Brightness across the Andromeda Nebula.—J. D. Kraus. (*Nature, Lond.*, 19th March 1955, Vol. 175, No. 4455, pp. 502–503.) Measurements made with the 96-helix aerial and improved receiver at the Ohio State University are reported; the frequency used was 250 Mc/s.

523.72 : 621.396.822.029.6 **2605**

Evidence of Limb-Brightening of the Sun at 60 cm Wavelength.—G. Swarup & R. Parthasarathy. (*Observatory*, Feb. 1955, Vol. 75, No. 884, pp. 8–9.) See 2607 below.

523.72 : 621.396.822.029.6 **2606**

The Sun in Two Dimensions at 21 cm.—W. N. Christiansen & J. A. Warburton. (*Observatory*, Feb. 1955, Vol. 75, No. 884, pp. 9–10.) See 2607 below.

523.72 : 621.396.822.029.6 **2607**

Distribution of Radio-Frequency Brightness across the Solar Disk at a Wavelength of 60 cm.—P. A. O'Brien & E. Tandberg-Hanssen. (*Observatory*, Feb. 1955, Vol. 75, No. 884, pp. 11–13.) Results of three investigations (see also 2605 and 2606 above) indicate appreciable limb brightening, contrary to results reported by Stanier (1401 of 1950). There has been a marked change of brightness during the sunspot cycle. The radial extent of the distribution is greater at the equator than at the poles.

523.74 : 538.6 : 550.385.4 **2608**

Magnetic Field of the Sun.—M. Waldmeier. (*Naturwissenschaften*, March 1955, Vol. 42, No. 6, pp. 149–151.) The principles of operation of Babcock's Zeeman-effect solar magnetograph (*Astrophys. J.*, Nov. 1953, Vol. 118, pp. 387–396) are described and some experimental results obtained (see e.g. *Astrophys. J.*, May 1954, Vol. 119, pp. 687–688) are shown in the form of magnetograms. The general magnetic-field strength is 1–2 oersted, of polarity opposite to that of the earth. Large local bipolar and unipolar fields have been observed and are shown in several of the magnetograms. The field distribution varies from day to day and fluctuations of the order of 1 oersted are believed to occur in local fields with periods of about 30 min. The unipolar fields are probably the sources of corpuscular emission which produce geomagnetic storms with a 27-day recurrence period.

523. 78 : 621.396.11 **2609**

Some Observations in Bratislava during the Solar Eclipse on 30th June 1954.—J. Šimaljak & A. Milerová. (*Bull. mét. tchécosl.*, 30th Nov. 1954, Vol. 7, No. 5, pp. 132–134. In Slovak.) Relative measurements were made of the total radiation (fig. 1.*a*1), radiation in the red (1.*a*2), yellow (1.*a*3) and ultraviolet (1.*a*4) bands, the air temperature (fig. 2), detected intensity of broadcast transmissions from Bratislava I (fig. 3) and the level of cosmic radiation (fig. 4). The maximum in fig. 3 occurred about 30 min before the minima in figs. 1 and 4.

550.3 **2610**

Scientific Programme of the International Geophysical Year 1957–58.—S. Chapman. (*Nature, Lond.*, 5th March 1955, Vol. 175, No. 4453, pp. 402–406.) An outline is given of comprehensive investigations planned in various branches of geophysics and allied subjects, including geomagnetism, the aurora, airglow, solar activity and ionospheric phenomena.

550.384 **2611**

Theories of the Earth's Magnetism.—D. R. Inglis. (*Rev. mod. Phys.*, April 1955, Vol. 27, No. 2, pp. 212–248.)

550.386 **2612**

A Semi-annual Periodicity in the Beginnings of Recurrent Magnetic Storm Series.—J. H. Rush. (*Nature, Lond.*, 19th March 1955, Vol. 175, No. 4455, pp. 517–518.)

551.510.535 **2613**

A Note on the World-Wide Distribution of the Sporadic-E Ionisation.—L. J. Prechner. (*Marconi Rev.*, 1st Quarter 1955, Vol. 18, No. 116, pp. 1–7.) A discussion based on data obtained during 1944–1945 from 31 ionospheric sounding stations, 10 of them in N. America. In geomagnetic mid-latitudes the prevalence of E_s clouds is greatest in local summer daytime. In the northern auroral and the equatorial zones no seasonal variation is apparent. In the auroral zone there is a daytime belt of intense E_s ionization and in the equatorial zone one at night-time. These belts have different characteristics and appear to have different causes. Very marked variation with longitude has been noted.

551.510.535 **2614**

A Particular Feature of the F_2 Layer at Lwiro [Central Africa].—G. Bonnet. (*Ann. Géophys.*, Oct./Dec. 1954, Vol. 10, No. 4, pp. 348–350.) Observations over the period January–May 1953 indicate that at the equinoxes the F_2 layer rapidly drops, sometimes to below 200 km, towards midnight, by an apparent contraction following an equally rapid expansion, often coinciding with the formation of a lower layer of measurable thickness corresponding to a night-time E layer.

551.510.535 : 523.78 : 621.396.81 **2615**

On Radio Measurements at Jabalpur during the Solar Eclipse of 30th June 1954.—Ghose, Roy, Gupta, Das Gupta, Sarwate & Mithal. (See 2725.)

551.510.535 : 550.38 **2616**

Some Geomagnetic Effects in the Equatorial F_2 Region.—N. J. Skinner & R. W. Wright. (*J. atmos. terr. Phys.*, April 1955, Vol. 6, No. 4, pp. 177–188.) Observations at Ibadan, Nigeria, during 1952 show that the midday minimum of the maximum concentration of ionization exhibited on magnetically quiet days disappears and is replaced by a maximum as the degree of magnetic disturbance increases. The total ion content below the height of maximum ionization varies similarly. Perturbations due to magnetic disturbance have both diurnal and semidiurnal components. Difficulties in the application of Martyn's theory (3301 of 1953) are discussed and certain modifications are suggested.

551.593.9 **2617**

On a New Method of Determining the Height of the Nightglow.—P. St. Amand, H. B. Pettit, F. E. Roach & D. R. Williams. (*J. atmos. terr. Phys.*, April 1955, Vol. 6, No. 4, pp. 189–197.) Nightglow observations taken at two stations separated by a distance comparable with the height of the layer observed will show correlation over a period if both stations observe the same point; the height of the point can hence be deduced. Observations taken during two successive nights give a height between 80 and 100 km for the origin of the 5 577-Å radiation.

551.594.221 **2618**

Equipment for Lightning Research on Monte San Salvatore.—K. Berger. (*Bull. schweiz. elektrotech. Ver.*, 5th March 1955, Vol. 46, No. 5, pp. 193–201.) The equipment has been appreciably augmented since the previous report (110 of 1948).

551.594.5 : 538.69 **2619**

The Significance of a Nonterrestrial Magnetic Field in Neutral-Stream Theories of the Aurora.—B. C. Landseer-Jones. (*J. atmos. terr. Phys.*, April 1955, Vol. 6, No. 4, pp. 215–226.) The hypothesis that a neutral stream of ions travels from the sun with a velocity of 10^8 cm/s in a magnetic field of strength 10^{-5} G fits observed data on aurorae and magnetic storms.

551.594.5 : 550.385 **2620**

On the Electric Field Theory of Magnetic Storms and Aurorae.—H. Alfvén. (*Tellus*, Feb. 1955, Vol. 7, No. 1, pp. 50–64.) The electric field theory is further developed. By taking into account the inertia of the beam of ionized gas emitted by the sun, the initial as well as the main phase of storms can be accounted for. See also 2621 below.

551.594.5 : 550.385 **2621**

Model Experiments on Aurorae and Magnetic Storms.—L. Block. (*Tellus*, Feb. 1955, Vol. 7, No. 1, pp. 65–86.) Experiments on a magnetized sphere [2426 of 1947 (Malmfors)] were performed to check Alfvén's theory (2620 above). Although a proper scaling down is not possible, some confirmation of the theory was obtained; in particular, the space charge accumulated in the discharge region discharges along the lines of magnetic force. Photographs of the discharge patterns produced at various electric and magnetic field strengths are shown and discussed.

551.594.5 : 621.396.96 **2622**

Radio Reflections from Aurorae: Part 2.—K. Bullough & T. R. Kaiser. (*J. atmos. terr. Phys.*, April 1955, Vol. 6, No. 4, pp. 198–214.) Observations made with a meteor-survey apparatus confirm the conclusions drawn previously (125 of January). The mean velocity of the reflecting regions changes from 600 m/s westwards at 1500 U.T., with diffuse echoes, to 600 m/s eastwards at 0500 U.T., with discrete echoes. There is a diurnal minimum of echo frequency between 2100 and 2200 U.T., when the reflecting regions appear to be at rest, and echoes are absent from 0600 to 1300 U.T. Correlation is observed between the radio echoes, the occurrence of visual aurorae and magnetic activity.

LOCATION AND AIDS TO NAVIGATION

621.396.93 **2623**

Use of Phase Measurements in a System for the Guiding and Location of Moving Objects.—J. Zakheim. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 137–141.) Discussion of the O.N.E.R.A. radio-alignment system, in which a c.w. signal radiated by the moving object is received on the ground by a system having two pairs of aerials, one pair spaced $\lambda/2$ apart, the other separated by a distance $\gg \lambda$. The phase difference between signals received by the individual aerials can be measured with high accuracy and the position of the moving object hence determined. More elaborate equipment measures the speed of the object and enables its trajectory to be corrected.

621.396.933 **2624**

Airborne Interrogator spots Location.—A. R. Applegarth. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 170–173.) Distance-measuring equipment in production as a result of the project described previously [2722 of 1951 (Borden et al.)] is described.

621.396.96 **2625**

Evaluation of Radar Sea Clutter.—A. H. Schooley. (*Tele-Tech & Electronic Ind.*, March 1955, Vol. 14, No. 3, pp. 70–71 . . 132.) A 1954 National Electronics Conference paper. Investigations of the statistical properties of a water surface disturbed by wind are discussed in relation to the design of military search radar.

621.396.96 **2626**

London Airport New-Type Radar.—(*Elect. J.*, 4th March 1955, Vol. 154, No. 9, p. 694.) The Type-S.232 radar operates in the 50-cm band, thus retaining full efficiency in bad weather. A moving-target-indicator system is used in which both the reference signal and the stabilization of transmitter and receiver frequencies are crystal-controlled. The one equipment can serve all airport radar requirements except precision approach. The aerial system comprises parabolic reflector with off-set horn.

621.396.96 : 538.566 **2627**

Elliptically and Circularly Polarized Electromagnetic Waves.—Bouix. (See 2601.)

621.396.96.095.1 **2628**

A Polarized Mirror Duplexer for use with a Circularly Polarized Lens Aerial.—J. F. Ramsay & W. F. Gunn. (*Marconi Rev.*, 1st Quarter 1955, Vol. 18, No. 116, pp. 29–36.) A simple alternative to the waveguide duplexer suggested in an earlier paper [2811 of 1952 (Ramsay)] is to use a closely spaced grating as a polarization-sensitive mirror, to separate two orthogonally polarized waves. A cross-talk factor of −65 db was obtainable for such a duplexer over the band 8·65–8·8 mm, or −75 db over a narrow band. A simple radar equipment incorporating this duplexer is discussed. An overall cross-talk factor of −55 db was obtainable over a 2% bandwidth.

621.396.962.2 : 621.396.621.54.029.6 **2629**

Local Oscillator for C.W. Radars.—H. B. Goldberg. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 166–167.) The need for a local X-band oscillator valve and special frequency-control circuits is avoided by using a crystal-controlled oscillator operating at the receiver i.f., which beats with a portion of the transmitter oscillator output, giving sidebands one of which is mixed with the received signal to obtain the desired i.f.

621.396.962.23 **2630**

Direction-Sensitive Doppler Device.—H. P. Kalmus. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 698–700.) A radar c.w. Doppler method is described in which, as well as the usual Doppler-frequency signal, a second signal with a 90° phase difference is produced, the sign of the phase difference depending on whether the target is approaching or receding. A single aerial with a low-loss duplexing arrangement using a gyrator is used. Various applications are indicated.

621.396.962.3 : 621.396.822 **2631**

Signal-Detection Studies, with Applications.—E. L. Kaplan. (*Bell Syst. tech. J.*, March 1955, Vol. 34, No. 2, pp. 403–437.) Curves are given relating the probability of detection of a signal in noise to the signal/noise ratio, to the proportion of false detections which can be tolerated, and to the time available. Three sets of conditions are considered: (*a*) steady sinusoidal signal, (*b*) fading sinusoidal signal, (*c*) signal varying as rapidly as noise. The curves are used to determine the best values of radar parameters, such as pulse energy, scan rate and averaging time.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.583 : 621.385 **2632**

Barium Getters in Carbon Monoxide.—J. Morrison & R. B. Zetterstrom. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 437–442.) The effectiveness of a 5-mg iron-clad Ba getter for cleaning up CO was studied as a function of pressure, temperature and physical state, using a method based on that of Wagener (122 of 1951). At CO pressures around 10^{-5} mm the getter is exhausted in about 1 000 h. The gettering rate is nearly independent of pressure over the range 10^{-5} mm–10^{-7} mm. Temperature variation from 25° to 150°C has little effect. Flashing in argon to obtain a diffuse deposit increased the gettering rate by a factor of two or three for the first hundred hours.

535.215 : 537.224 **2633**

Persistent Internal Polarization.—H. Kallmann & B. Rosenberg. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1596–1610.) Experimental studies on the production of polarization in photoconductive fluorescent substances of high dark resistance, by the action of various kinds of wave and particle radiation in the presence of a unidirectional electric field are reported. Effects similar to those in electrets are produced. The polarization is due to a partial separation by the applied field of free charges produced by the radiation, and to their trapping. The mechanisms involved are discussed.

535.215 : 546.817.231 **2634**

Preparation of Sensitive PbSe Photoconductors.—H. Gobrecht, F. Niemeck & F. Speer. (*Naturwissenschaften*, March 1955, Vol. 42, No. 6, p. 152.) A brief note on infrared-sensitive PbSe layers prepared by a method similar to that used for InSe by Bode and Levinstein (1777 of 1954). Sensitivity at room temperature is increased to an appreciable level by interrupting the vacuum heat treatment by exposure to air at about 120°C.

535.37 **2635**

Fundamental Law of Escape from Traps [in phosphors]**.**—D. Curie. (*C. R. Acad. Sci., Paris*, 13th April 1955, Vol. 240, No. 15, pp. 1614–1616.)

537.226/.227 **2636**

Optical Study of $PbZrO_3$ and $NaNbO_3$ Single Crystals.—F. Jona, G. Shirane & R. Pepinsky. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1584–1590.) Investigations throwing light on the mechanism of antiferroelectric transitions in perovskite-type crystals are described.

537.227 : 546.431.824-31 : 534.2-8 **2637**

Ultrasonic Attenuation Studies in Biased $BaTiO_3$ Ceramics.—T. F. Hueter & D. P. Neuhaus. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 292–296.) Observations were made of the variation with temperature and with applied field of the ultrasonic attenuation produced by polycrystalline $BaTiO_3$; pulses of 10-Mc/s vibrations were used. Maxima in the attenuation/field-strength curve are observed for those values at which the electromechanical response varies rapidly. The observations are related to domain-wall movements of two kinds. In both cases the losses appear to be caused by elastic hysteresis due to dislocation movement.

537.228.1 **2638**

Piezoelectric Effect in Wood.—V. A. Bazhenov. (*Trud. Inst. Lesa*, 1953, Vol. 9, pp. 281–314; *Referativnyi Zh., Fiz.*, March 1955, No. 3, pp. 172–173, Abstract 4950.) The piezoelectric effect was observed in dried specimens of oak, pine, birch and beech; the effect was not noticeable in some isotropic woods. The magnitude of the constant d_{14} ($= -d_{25}$) ranged between $0{\cdot}3 \times 10^{-8}$ and $0{\cdot}7 \times 10^{-8}$ e.s.u., i.e. about one tenth of the constant d_{11} for quartz. The dependence of the piezoelectric properties on the temperature, humidity and dimensions of specimens was also investigated. The piezoelectric effect in wood is shown to be due to the presence of cellulose.

537.311.3.023 : [537.226.2 + 538.213 **2639**

Effective Electrical Conductivity of a Medium with Inclusions.—I. K. Ovchinnikov & G. G. Kilyukova. (*Bull. Acad. Sci. U.R.S.S., sér. géophys.*, Jan./Feb. 1955, No. 1, pp. 57–59. In Russian.) Formulae are given for the conductivities parallel to the Cartesian coordinate axes of a medium with embedded conducting particles in the form of ellipsoids. The formulae also apply to calculations of the dielectric constant and the effective permeability, and can be adapted to deal with particles of other shapes. Calculated and experimental results are tabulated and show good agreement.

537.311.31 **2640**

Resistivity in Metals. Resistivity Changes by Plastic Deformation of Polycrystalline Metals.—H. G. van Bueren & P. Jongenburger. (*Nature, Lond.*, 26th March 1955, Vol. 175, No. 4456, pp. 544–545.) Resistivity measurements have been made on annealed wires of 99·99% pure Cu and Ag plastically deformed in extension and in torsion at 20°K and at 77°K. The results are discussed in terms of dislocations and point defects; the latter are apparently responsible for nearly all the resistivity increase associated with the plastic deformation.

537.311.31 **2641**

Resistivity in Metals. Extra-Resistivity due to Interstitial Atoms in Copper.—P. Jongenburger. (*Nature, Lond.*, 26th March 1955, Vol. 175, No. 4456, pp. 545–546.) An approximate calculation is presented.

537.311.33 **2642**

Transport Properties of a Many-Valley Semiconductor.—C. Herring. (*Bell Syst. tech. J.*, March 1955, Vol. 34, No. 2, pp. 237–290.) In the semiconductor conduction-band model discussed, the energy of an electron, considered as a function of its wave-number vector, has a number of minima, or 'valleys'. For the valence band the conditions are inverted. For models of this type the theory is developed for (*a*) mobility and its temperature dependence, (*b*) thermoelectric power, (*c*) piezoresistance, (*d*) Hall effect, (*e*) h.f. dielectric constant, and (*f*) magnetoresistance. These phenomena are treated, for the cases to which Maxwellian statistics apply, on the assumption that the scattering of the charge carriers can be represented by a relaxation time which depends on energy only, but is otherwise unrestricted. Special attention is given to the role of inter-valley lattice scattering.

537.311.33 **2643**

Considerations on the Location of Generation and Recombination Phenomena at Contact Barriers and at the Surface of a Semiconductor.—N. Nifontoff. (*C. R. Acad. Sci., Paris*, 18th April 1955, Vol. 240, No. 16, pp. 1634–1636.) Assuming that the energy levels of traps are distributed uniformly over the forbidden band, it is shown on the basis of theory developed by Shockley & Read (420 of 1953) that carrier generation and recombination are maximum for traps at the neutral level, i.e. the Fermi level or midway between quasi-Fermi levels. These considerations explain observed phenomena such as high recombination rate near a free surface, the occurrence of Zener current in *p-n* junctions at high reverse voltage, and certain photoelectric effects.

537.311.33 **2644**

Injected Current Carrier Transport in a Semi-infinite Semiconductor and the Determination of Lifetimes and Surface Recombination Velocities.—W. van Roosbroeck. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 380–391.) "With both surface and volume recombination taken into account, time-dependent and steady-state Green's functions are obtained for a point source of added carriers in a semi-infinite semiconductor, and for infinite line and plane sources parallel to the surface. Small-signal theory is employed, and a compact Stieltjes-integral derivation is given. The Green's functions are specialized to provide: the time dependence of surface concentration following the instantaneous injection of carriers at a point on the surface; that following instantaneous injection which is uniform over the surface; and the distance dependences for steady point, infinite-line, semi-infinite plane, and semi-infinite line surface sources. Steady flows of minority carriers from these sources into a *p-n* junction perpendicular to the surface are also calculated. Analytical approximations are found for the steady-source cases. Theoretical and experimental aspects of the determination of lifetimes and surface recombination velocities from data by means of these results are discussed."

537.311.33 : 535.215 **2645**

Photoconductivity in Calcium Tungstate.—J. R. Cook. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 148–155.) Measurements on artificial single crystals indicate that photoconductivity is produced on exposure to ultraviolet radiation. The material is an intrinsic semiconductor with an activation energy of 2·1 eV.

537.311.33 : 535.215 : 538.63 **2646**

Photodiffusion Current Hall Effect: Transient Behavior.—L. H. Hall. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1471–1474.) Theory is developed to account for the voltage peak preceding the steady-state value, as observed by Bulliard (3231 of 1954).

537.311.33 : 537.52 : 621.315.61 **2647**

Space-Charge-Limited Currents in Solids.—A. Rose. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1538–1544.) Theory is developed for the processes described by Smith & Rose (2666 below). The relation of these processes to breakdown in insulators is discussed.

537.311.33 : 537.58 : [546.28 + 546.289 **2648**

Thermal Ionization and Capture of Electrons Trapped in Semiconductors.—H. Gummel & M. Lax. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1469–1470.) Calculations are made of the ionization and capture probabilities for Si and Ge, using Coulomb wave functions. The results are consistent with the upper limit to the lifetime of photoconductive carriers determined experimentally by Burstein et al. (*Phys. Rev.*, 1st Jan. 1953, Vol. 89, No. 1, pp. 331–332).

537.311.33 : [546.28 + 546.289 **2649**

Theory of the Infrared Absorption of Carriers in Germanium and Silicon.—A. H. Kahn. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1647–1652.) The Drude-Zener theory is used to study infrared absorption in *n*-type Ge and *p*-type Si. Average values are determined for the effective masses of electrons in Ge and holes in Si. Infrared absorption bands in *p*-type Ge are explained on the basis of transitions of holes between three energy bands lying near the top of the valence band, this structure being suggested by cyclotron resonance experiments. On the basis of this theory, absorption peaks are to be expected at wavelengths near 25 μ and 33 μ for *p*-type Si.

537.311.33 : 546.28 **2650**

Theory of Donor Levels in Silicon.—W. Kohn & J. M. Luttinger. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, p. 1721.) Extension of theory presented by Luttinger & Kohn (1390 of May).

537.311.33 : 546.28 **2651**

Excited Donor Levels in Silicon.—W. H. Kleiner. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1722–1723.)

537.311.33 : 546.28 **2652**

On the Measurement of Minority-Carrier Lifetime in *n*-Type Silicon.—J. B. Arthur, W. Bardsley, A. F. Gibson & C. A. Hogarth. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 121–129.) Four known methods are examined and discrepancies between the results are discussed. Precautions necessary to obtain valid results with the travelling-light-spot method are indicated. Erroneous results may be obtained if methods developed for measurements on Ge are applied indiscriminately to other semiconductors.

537.311.33 : 546.28 **2653**

Radioactivation Analysis of Arsenic in Silicon.—J. A. James & D. H. Richards. (*Nature, Lond.*, 30th April 1955, Vol. 175, No. 4461, pp. 769–770.) Outline of a method for determining sub-microgram quantities of arsenic impurity, involving irradiation of the impure Si specimen with thermal neutrons.

537.311.33 : 546.28 **2654**

Densitometric and Electrical Investigation of Boron in Silicon.—F. H. Horn. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1521–1525.) Results of this investigation confirm that boron resides substitutionally in the Si lattice for concentrations up to 0·3 atom %.

537.311.33 : 546.289 **2655**

Thermoelectric Power of Germanium at Low Temperatures.—E. Mooser & S. B. Woods. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1721–1722.) Measurements are reported providing evidence of a contribution to the thermoelectric power due to electron scattering by lattice vibrations with a bias towards the colder end of the sample [3498 of 1947 (Gurevich)].

537.311.33 : 546.289 **2656**

Infrared Absorption of Germanium near the Lattice Edge.—G. G. Macfarlane & V. Roberts. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1714–1716.) Observations are reported giving results in agreement with calculations made by Hall et al. (152 of January) for indirect transitions of valence electrons.

537.311.33 : 546.289 **2657**

Measurement of the Lifetime of Minority Carriers in Germanium.—W. G. Spitzer, T. E. Firle, M. Cutler, R. G. Shulman & M. Becker. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 414–417.) Two methods are described, both useful for measuring the lifetime in a small region rather than the average value over the sample. One is a modification of the method described by Haynes & Shockley (1928 of 1951), using pulsed injection of carriers into a filament with detection, after a known delay, at a spaced collector. The other is based on the decay of the spreading resistance resulting from injection of carriers at a point contact, as described by Many (2129 of 1954).

537.311.33 : 546.289 **2658**

Breakdown Effect in *p-n* Alloy Germanium Junctions.—R. D. Knott, I. D. Colson & M. R. P. Young. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 182–185.) Two forms of breakdown mechanism identified by McKay & McAfee in grown junctions (1079 of 1954) are investigated in relation to alloyed-In junctions. Observed and theoretically predicted results both indicate that for Ge of resistivity $> 0{\cdot}5\,\Omega$.cm avalanche breakdown occurs, while for resistivity $< 0{\cdot}5\,\Omega$.cm field-emission theory applies.

537.311.33 : 546.289 **2659**

Germanium in Power-Station Boiler Plant.—J. S. Forrest, A. C. Smith & J. M. Ward. (*Nature, Lond.*, 26th March 1955, Vol. 175, No. 4456, p. 558.) Determinations have been made of the quantity of Ge in over 60 samples of dust and deposits taken from various types of steam-raising plant of the British Electricity Authority. The results indicate that deposits from such sources only occasionally contain useful amounts of Ge. Experiments are planned on the effect of pyrites and chlorides of Na and K on the release of Ge during the combustion of coal.

537.311.33 : 546.289 : 621.396.822 **2660**

Variation of Noise with Ambient in Germanium Filaments.—T. G. Maple, L. Bess & H. A. Gebbie. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 490–491.) An experimental investigation of $1/f$ noise in semiconductors is reported briefly. Noise-power/frequency curves are shown for filaments immersed successively in dry N_2 and in liquid CCl_4, the filament surface being in one case sand-blasted and in the other case etched. The observations for N_2 are consistent with the addition of $1/f$ noise and shot noise, those for CCl_4 are not.

537.311.33 : 546.368.63 **2661**

Hall Effect in Cesium Antimonide with Audio-frequency Currents.—T. Sakata. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 1030–1031.) Variations in the Hall effect over the temperature range 189°–357°K are investigated for various Cs_3Sb samples; results are tabulated.

537.311.33 : 546.368.63 **2662**

On the Thermoelectric Power of Cesium Antimonide.—T. Sakata. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 1031–1032.) Thermoelectric power measurements were made over the temperature range 220°–305°K. Values of Hall coefficient computed from these measurements are uniformly higher than those previously measured (2661 above).

537.311.33 : 546.431-31 **2663**

On the Optical Absorption of Thin BaO Films in the Ultraviolet Region.—K. Takazawa & T. Tomotika. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 996–1000.) A hitherto unreported absorption band with a maximum at about 3 000 Å was observed, which coincides with the first maximum of photoconductivity in BaO single crystals. It vanished when the film was exposed to oxygen.

537.311.33 : 546.482.21 **2664**

Temperature Dependence of the Hall Effect and the Resistivity of CdS Single Crystals.—F. A. Kröger, H. J. Vink & J. Volger. (*Philips Res. Rep.*, Feb. 1955, Vol. 10, No. 1, pp. 39–76.) Measurements were made on CdS crystals, pure, and doped with Ga and Cl, in the temperature range 25°–700°K. Peaks in the Hall-constant/temperature curves indicate a double-band conduction mechanism. At room temperature electron mobility in the normal conduction band is about 210 cm/s per V/cm; mobility in the donor band increases both with the concentration of donors and with the number of electrons. In the case of insulating crystals, the reduction of photocurrent on application of additional infrared irradiation is due to the latter decreasing the concentration of free electrons, mobility being unaffected; l.f. capacitance measurements give a value of 11·6 ± 1·5 for dielectric constant. 51 references.

537.311.33 : 546.482.21 **2665**

Properties of Ohmic Contacts to Cadmium Sulfide Single Crystals.—R. W. Smith. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1525–1530.) Indium and gallium have been found to make good nonrectifying noise-free contact with CdS crystals, thus facilitating experimental investigation of the rectifying and photoconductive properties of the material. Various measurements are reported.

537.311.33 : 546.482.21 **2666**

Space-Charge-Limited Currents in Single Crystals of Cadmium Sulfide.—R. W. Smith & A. Rose. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1531–1537.) Using a pair of the nonrectifying contacts described by Smith (2665 above), currents of 20 A/cm^2 have been drawn through unilluminated crystals of CdS. Experimental evidence indicates that these currents are space-charge-limited. The value of the current is lower by several orders of magnitude than that obtained with a trap-free solid; hence this type of experiment should be useful for measuring trap concentration.

537.311.33 : 546.681.86 **2667**

Electrical Properties of Gallium Antimonide.—D. P. Detwiler. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1575–1578.) Measurements are reported on some p-type samples and one n-type sample over the temperature range −196° to 650°C. The intrinsic energy gap is 0.78 eV at −196°C. The mobility of electrons in n-type material is several times greater than the hole mobility. The problem of preparing the material with a purity comparable to that of Ge is discussed.

537.311.33 : 546.817.221 **2668**

Mobility of Electrons and Holes in the Polar Crystal, PbS.—R. L. Petritz & W. W. Scanlon. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1620–1626.) Hall coefficient and resistivity values determined experimentally by Brebrick & Scanlon (1410 of May) are used to calculate mobility curves for PbS; these are used as a basis for discussing theoretical work on mobility in polar crystals and to derive estimates of the effective masses of electrons and holes.

537.311.33 : 621.314.7 **2669**

Comparative High-Frequency Operation of Junction Transistors made of Different Semiconductor Materials.—Giacoletto. (See 2782.)

538.221 **2670**

Ferromagnetic Resonance Absorption in Colloidal Suspensions.—D. M. S. Bagguley. (*Proc. roy. Soc. A*, 22nd March 1955, Vol. 228, No. 1175, pp. 549–567.) Suspensions of pure metals and alloys have been investigated at wavelengths of 3·14 and 1·25 cm, at 290°K. The g-factor for Fe is 2·06 ± 0·02 and for Ni 2·22 ± 0·02. In the Ni-Fe alloys anomalous variation of g-factor with Ni content is observed. Except in the case of Ni there is good agreement between results from the microwave measurements and those from gyromagnetic experiments. The half-width of the absorption line for Fe is 700 oersteds ± 10%. For the face-centred alloys the line width varies smoothly with a minimum value of 300 oersteds near 70% Ni.

538.221 : 537.323 **2671**

Magneto-thermoelectric Powers of Nickel Single Crystals.—N. Miyata & Z. Funatogawa. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 967–973.) The change of thermoelectric power due to magnetization, E_m, was measured on Ni single crystals, and calculated for the [100] and [111] directions; the values obtained at room temperature are 0·57 μV/°C and 0·69 μV/°C respectively. E_m values reach a maximum around room temperature. E_m is positive except near the Curie point, where it may be negative due to additive magnetization proportional to the external magnetic field.

538.221 : 538.569.4 **2672**

The Relaxation Process in Ferromagnetic Resonance Absorption.—T. Kasuya. (*Progr. theor. Phys.*, Dec. 1954, Vol. 12, No. 6, pp. 802–805.) Results of analysis based on the spin-wave approximation suggest that the line width in ferrites is determined mainly by lattice imperfections causing interaction between spin waves having zero and nonzero vectors. Discussion gives support to the view that in metals such as Ni, as opposed to ferrites, processes involving interaction with conduction electrons are of greater importance than collisions between spin waves.

538.221 : 538.652 **2673**

The Temperature Dependence of Magnetostriction in a Nickel Crystal.—W. D. Corner & G. H. Hunt. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423A, pp. 133–144.) Using the capacitance bridge described in 1752 of June, the longitudinal magnetostriction of prolate-spheroid specimens prepared from a Ni single crystal was measured over the temperature range −180° to 360°C. The results indicate that at low temperatures the magnetostriction below saturation varies with magnetization approximately in accordance with Heisenberg's domain theory; with increasing temperature there is a steady departure from the calculated values. The variation of saturation magnetostriction with temperature did not correspond to any known theory.

538.221 : 621.318.134 **2674**

Motion of Individual Domain Walls in a Nickel-Iron Ferrite.—J. K. Galt. (*Bell Syst. tech. J.*, March 1955, Vol. 34, No. 2, pp. 439–441.) Correction to paper abstracted in 175 of January.

548.5 : 549.514.51 **2675**

Influence of Impurities on the Growth of Quartz Crystals from Flint and Quartzite.—C. S. Brown, R. C. Kell, P. Middleton & L. A. Thomas. (*Nature, Lond.*, 2nd April 1955, Vol. 175, No. 4457, pp. 602–603.) Processes are described by means of which quartz crystals can be grown from readily available flint and quartzite, having properties similar to those of crystals grown from melting-quality quartz.

621.315.5/.6 + 621.318.22 **2676**

The Development of New Materials.—F. E. Robinson. (*Marconi Rev.*, 2nd Quarter 1955, Vol. 18, No. 117, pp. 60–68.) The review presented earlier (3166 of 1949) is brought up to date. Permanent-magnet materials are included.

621.315.6 **2677**

Dielectric Properties of Pinacol Hydrate: Application to Temperature Measurement.—J. S. Dryden & R. J. Meakins. (*Nature, Lond.*, 2nd April 1955, Vol. 175, No. 4457, p. 603.) This material is found to have a permittivity variation of 5·5% per degree C at a dispersion region centred about a frequency of 80 kc/s at 20°C.

621.315.616 **2678**

Conductivity induced in Unplasticized 'Perspex' by X-Rays.—J. F. Fowler & F. T. Farmer. (*Nature, Lond.*, 19th March 1955, Vol. 175, No. 4455, pp. 516–517.) Differences from the behaviour of the plasticized material (2153 of 1954) are noted. Unplasticized perspex is grouped with polyethylene, polytetrafluorothene and polystyrene, all of which display an exponential distribution of traps in depth.

621.315.616.9 **2679**

Conductivity Induced by X-Rays in Polyethylene Terephthalate: a Possible Insulator for Radiological Apparatus.—J. F. Fowler & F. T. Farmer. (*Nature, Lond.*, 2nd April 1955, Vol. 175, No. 4457, pp. 590–591.)

621.315.616.9.011.5 **2680**

Dependence of Coefficient of Dielectric Losses ϵ'' of Polar Polymers on Temperature.—P. F. Veselovski. (*Zh. tekh. Fiz.*, Feb. 1955, Vol. 25, No. 2, pp. 266–269.)

621.318.134 : 538.566.029.6 : 538.6 **2681**

On the Microwave Cotton-Mouton Effect in Ferroxcube.—F. K. du Pré. (*Philips Res. Rep.*, Feb. 1955, Vol. 10, No. 1, pp. 1–10.) The effect investigated is the splitting of a microwave beam traversing a ferrite to which a transverse magnetic field is applied. Measurements were made at 9·35 kMc/s on a sample of ferroxcube IVB held between two glass plates, to determine the phase difference of the emergent waves as a function of the field intensity. Results are in fair agreement with theory for the simplified case of plane-wave transmission through a ferrite with small damping loss. Considerable phase differences can be produced by small applied fields.

669.046.54 **2682**

Cage Zone Refining.—P. H. Brace, A. W. Cochardt & G. Comenetz. (*Rev. sci. Instrum.*, March 1955, Vol. 26, No. 3, p. 303.) Need for a crucible is avoided by preparing the specimen in an elongated form with polygonal cross-section. On passing such a specimen longitudinally through a short induction coil, a short length of the specimen can be kept molten throughout its interior while the edges, or attached fins, remain solid and constitute the 'cage'. The method is not suitable for growing single crystals.

MEASUREMENTS AND TEST GEAR

531.76 : 621.318.57 **2683**

Short-Interval Timer.—N. A. Moerman. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 168–169.) The timer comprises a counter circuit in which delay in registering the stop pulse of a period is eliminated by a bypass circuit.

621.3.018.41(083.74) : 621.373.4 **2684**

High-Stability Bridge-Balancing Oscillator.—P. G. Sulzer. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 701–707.) A frequency-standard unit in which the frequency varies by only a few parts in 10^{10} over a day has a 1-Mc/s GT-cut crystal serving as resonator both for the oscillator and for the bridge from which the automatic frequency control voltage is obtained. See also 1726 of June (Lea).

621.314.5.024.12 : 621.317.3 **2685**

A Generator for Very Small Direct Currents.—K. D. E. Crawford. (*J. sci. Instrum.*, April 1955, Vol. 32, No. 4, pp. 128–131.) A linearly changing voltage with rate of change controlled by a differentiating circuit is applied to a specially constructed, cylindrical capacitor. The output current can be varied between 2×10^{-17} and 2×10^{-10} A. Source resistance is $> 10^{16}\,\Omega$. Applications in calibrating current-measuring devices and in measuring high resistance and possibly capacitance are noted.

621.314.7.001.4 **2686**

The Measurement and Display of the Current Gain (α) of a Transistor as a Function of Emitter Current.—Hilbourne. (See 2784.)

621.317.328 **2687**

Visual Display of Electromagnetic Waves.—H. Kleinwächter. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 154–156.) The method described is suitable for observing microwave radiation fields with large intensity variations, such as the diffraction field behind a conducting screen. A test signal from a klystron modulated at 5 kc/s is compared for phase and amplitude with that picked up by an electric-dipole probe carrying a lamp controlled by the detector. The probe is guided along concentric arcs and the fluctuations of lamp brightness are recorded photographically.

621.317.328 : 621.372.413 **2688**

A Method of Measuring the Intensity Distributions of Radio-Frequency Electronic and Magnetic Fields in Resonant Cavities.—J. G. Linhart & T. H. B. Baker. (*Brit. J. appl. Phys.*, March 1955, Vol. 6, No. 3, pp. 100–103.) The method is based on changes in resonance frequency and *Q* factor caused by introduction of a small sphere of dielectric or ferromagnetic material. See also 2265 of 1952 (Maier & Slater).

621.317.329 : 621.385.029.6 **2689**

A Proposed Method of investigating the Field Distribution in a Magnetron.—Aikin. (See 2792.)

621.317.331 : 537.311.33 **2690**

Theoretical Bases of the Probe Method of Measurement of Resistivity and Hall Constant.—J. Laplume. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 113–125.) Theory of the method described by Pistoulet (*ibid.*, Jan. 1955, Vol. 35, No. 334, pp. 82–87). See also 1502 of 1954 (Valdes).

621.317.333.6 **2691**

Solid-Dielectric Breakdown Techniques.—J. J. Chapman, L. J. Frisco & J. S. Smith. (*J. electrochem. Soc.*, Feb. 1955, Vol. 102, No. 2, pp. 67–72.) Solder sprayed from a gun into a properly shaped cavity in the specimen under test formed an embedded electrode which was found satisfactory for breakdown-strength measurements at frequencies between 60 c/s and 100 Mc/s and at temperatures between −55°C and 125°C. The technique used is described.

621.317.333.8 **2692**

Automatic Control and Display in Impulse Testing.—R. F. Saxe. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 371–374.) Circuits are described for triggering the impulse generator automatically at a preset charging voltage, enabling the peak voltage and duration of the waveform to be displayed on ordinary meters rather than on a c.r.o.

621.317.337 : 621.372.412 **2693**

Determination of Quality Factor of Quartz Crystals in Parallel Resonance.—G. Brunner & A. Lösche. (*Z. angew. Phys.*, Feb. 1955, Vol. 7, No. 2, pp. 67–71.) An analysis is made of the response of a parallel-tuned circuit to a voltage whose frequency varies linearly with time; the differential equation involved is solved by suitable transformations. The final expression gives the instantaneous voltage across the tuned circuit in terms of the instantaneous value of the driving current and of a function of the circuit parameters; this latter function, the Fresnel function [671 of 1949 (Hok)], is shown graphically. In the experimental arrangement described, the Fresnel function is displayed on a c.r.o. screen and hence by comparison with the plotted function the quality factor can be deduced. See also 2058 of July (Mayer).

621.317.35 : 621.3.018.78 **2694**

Measurement of Nonlinearity Distortion.—M. G. Scroggie. (*Wireless World,* July 1955, Vol. 61, No. 7, pp. 317–323.) The degree of distortion caused by sound-reproducing equipment should be expressed simply and so as to correspond with aural judgment. Various methods of measurement are discussed; adoption of a fixed distortion-product frequency between 1 000 and 2 000 c/s is suggested, with two input signals whose amplitudes are in the ratio 4 : 1.

621.317.361 : 621.396.822 **2695**

Mean Frequency Determination of Narrow-Band Noise Spectra.—W. W. H. Clarke & R. F. Nikkel. (*Proc. Instn elect. Engrs,* Part B, May 1955, Vol. 102, No. 3, pp. 364–370.) The design is discussed of a magnetic-amplifier servo-loop system for continuously measuring the mean frequency of a signal whose energy/frequency characteristic approximates to a symmetrical Gaussian distribution. Spectra of this type can be obtained by passing white noise through two Π sections of a constant-*k* filter. The effect of signal deviation from the assumed characteristics is discussed, and the degree of signal asymmetry which can be tolerated without undue loss of accuracy is indicated.

621.317.7 **2696**

Considerations of Mechanical Shock in the Loading and Testing of Instruments.—K. Hintermann. (*Bull. schweiz. elektrotech. Ver.,* 5th March 1955, Vol. 46, No. 5, pp. 201–206.) The subject is discussed with reference to a vibrating-plate frequency meter.

621.317.7 : 778.3 **2697**

Equipment of Instrumental Accuracy for Recording and Reproduction of Electrical Signals, using Cinematographic Film.—H. McG. Ross. (*Proc. Instn elect. Engrs,* Part B, May 1955, Vol. 102, No. 3, pp. 323–339. Discussion, pp. 339–342.) A description is given of apparatus designed as an adjunct to electrical measuring equipment, covering the frequency range 0–1 kc/s; the errors are about 1% over most of the range. The film records are reproduced by means of a photocell arrangement. Comparison is made between disk, magnetic-tape and kinematographic recording systems for this application.

621.317.7.029.6 : 621.372.8 **2698**

The Squeeze Section, a Simple and Universal Measurement Apparatus for Centimetre Wavelengths.—H. Severin. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.,* 1st March 1955, Vol. 33, No. 3, pp. 130–135. In German.) Impedance measurements can be made conveniently using a waveguide having a region with adjustable cross-section. The geometrical length from the test object to the probe remains fixed, the determination being based on the relation between the mechanical deformation and the electrical length of the line. The device is also useful as a precision phase shifter. See also 21 of January.

621.317.725.082.72 **2699**

An Attracted-Disc Absolute Voltmeter.—G. W. Bowdler. (*Proc. Instn elect. Engrs,* Part B, May 1955, Vol. 102, No. 3, pp. 301–309. Discussion, pp. 310–312.) Details are given of the design and performance of an instrument operating in compressed gas. Measurement accuracy is within about 1% at 1 kV and about 0·1% at 30 kV and above.

621.317.726 **2700**

Automatic Slide-Back Voltmeter.—H. J. Fraser. (*Wireless Engr,* July 1955, Vol. 32, No. 7, pp. 187–189.) The instrument described was designed to indicate directly the peak voltage of recurring positive pulses as used e.g. for valve testing. The pulses are applied to a diode detector which is automatically biased so that the difference between the input voltage and the slide-back bias is small. The slide-back bias is obtained by integrating the output pulses of a multivibrator which is triggered by this difference voltage. Experimental results are presented for pulse widths of 0·5–50 μs and repetition rates of 10–20 000 pulses/s. The maximum error is $\pm$ 2 V over the range 0–100 V.

621.317.726 **2701**

A Transient-Voltage Measuring Instrument.—(*Elect. J.,* 18th March 1955, Vol. 154, No. 11, p. 917.) Description of a commercially available peak voltmeter in which the control grid of a thyratron is connected to a tapping switch on a noninductive potentiometer across which the transient is applied. Indication of the firing of the thyratron is given by a neon lamp. The maximum permissible continuous input voltage, either alternating or direct, is 2·24 kV. Voltages > 35 kV can be measured.

621.317.729 : 621.372.5 **2702**

Electrolyte Tank for solving Network Problems.—V. Met. (*Frequenz,* Feb. 1955, Vol. 9, No. 2, pp. 57–63.) The tank described is of a form which is the result of a reflection and two different conformal transformations of the complex frequency plane, by means of which the positive $j\omega$ axis is reproduced on the circular perimeter of the trough. This reduces the errors due to inaccurate electrode positioning. Measurements are limited to the determination of potential; the current function is determined by graphical integration. The accuracy of the method is illustrated by a simple example.

621.318.4.013.2 : 621.317.4 **2703**

A Screened Uniform Magnetic Field.—E. G. Schlosser. (*Z. angew. Phys.,* Feb. 1955, Vol. 7, No. 2, pp. 59–61.) The production is considered of a highly uniform magnetic field by means of a pair of Helmholtz coils symmetrically placed inside a high-permeability cylindrical container with end plates. The optimum dimensions of the system are stated and the experimentally determined radial variation of the field parallel to the axis is shown graphically, both for the screened arrangement and the usual Helmholtz coil arrangement. The calculated characteristics agree well with those determined experimentally.

621.385.001.4 **2704**

An Inflection-Point Emission Test.—Hopkins & Shrivastava. (See 2787.)

621.385.001.4 **2705**

Subminiature-Tube Reliability Testing.—Bickel. (See 2788.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.2-8 **2706**

A Method of Transducing an Ultrasonic Shadowgraph or Image for Display on an Oscilloscope.—E. E. Suckling & W. R. MacLean. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 297–301.) A pattern of piezoelectric voltage set up on the surface of a quartz plate, corresponding to the pattern of an exciting ultrasonic field, is scanned capacitively.

534.222.2 : 621.396.96 **2707**

Measurement of Detonation Velocity by Doppler Effect at Three-Centimeter Wavelength.—M. A. Cook, R. L. Doran & G. J. Morris. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 426–428.) The ionized wave front of the detonation wave acts as a moving reflector for e.m. waves directed against it. Results are reported for four solid explosives. Complexities in the observed Doppler patterns occur because the cylindrical charges act as multimode dielectric waveguides.

621.317.083.7 **2708**

Data Reduction System for Missile Telemetering.—E. M. McCormick. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 126–130.) F.m./f.m. telemeter signals recorded on magnetic tape produce a pulse train proportional to the original function which is recorded on punched cards for processing.

621.317.39 : 531.714.7 **2709**

Design Criteria for Mutual-Inductance Transducers.—(*Tech. News Bull. nat. Bur. Stand.*, March 1955, Vol. 39, No. 3, pp. 36–37.) Developments in the design of Greenough's electronic micrometer (1129 of 1948) are embodied in a series of recommendations. The reference plate should be as nearly a perfect conductor as possible; the primary coil should be as large as possible and should be coplanar with the secondary coil, or should be the further of the two from the reference plate; leads to the coils should be shielded from one another; excitation frequency should be as high as possible.

621.317.39 : 531.78 : 537.228.1 **2710**

Piezoelectrical Measurement of Force.—H. H. Rust & J. Krohn. (*Z. angew. Phys.*, Feb. 1955, Vol 7, No. 2, pp. 61–67.) The charge which appears on a stressed quartz plate is converted into an alternating voltage by means of a variable capacitor comprising a modified telephone receiver vibrating at a few tens of cycles per second. The theory and the electrical and mechanical design are discussed. If no corrections are made, the error in the determination of force over a period of 30 sec is about 2·5%. Forces down to 0·01 pond (9·81 dynes) can be measured.

621.317.39 : 621.317.755 : 621.43 **2711**

A Versatile Electronic Engine Indicator.—R. K. Vinycomb. (*J. Brit. Instn Radio Engrs*, May 1955, Vol. 15, No. 5, pp. 235–246.) Trolley-mounted c.r.o. equipment is described, for use with several types of transducer, permitting a wide range of measurements.

621.384.622 : 621.385.833 **2712**

Lateral Stabilization of the Ion Beam in a Linear Accelerator by Grid-Type Electrostatic Lenses.—M. Y. Bernard. (*C. R. Acad. Sci., Paris*, 18th April 1955, Vol. 240, No. 16, pp. 1636–1638.)

621.385.833 **2713**

Recent Developments in Electron Microscopy.—V. E. Cosslett. (*Research, Lond.*, Feb. 1955, Vol. 8, No. 2, pp. 48–56.) Advances in lens design, the production of commercial instruments, and techniques for the preparation of specimens are reviewed. 51 references.

621.385.833 **2714**

A Reflection Electron Microscope.—V. E. Cosslett & D. Jones. (*J. sci. Instrum.*, March 1955, Vol. 32, No. 3, pp. 86–91.) Description of apparatus for examining solid surfaces illuminated by an electron beam at grazing incidence; magnification is continuously variable from x 500 to x 10 000.

621.385.833 **2715**

Two New Simplified Systems for the Correction of Spherical Aberration in Electron Lenses.—G. D. Archard. (*Proc. phys. Soc.*, 1st March 1955, Vol. 68, No. 423B, pp. 156–164.)

621.385.833 **2716**

Precise Determination of Cardinal Elements in Strongly Converging [electron] **Lenses.**—M. Y. Bernard. (*C. R. Acad. Sci., Paris*, 13th April 1955, Vol. 240, No. 15, pp. 1612–1614.)

621.396.934 **2717**

Information required for Missile Guidance.—F. P. Adler. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, p. 492.) Calculations and discussion indicate that the amount of information and the information rates required for guiding a missile are quite small, so that it should be possible to guide it by talking to it slowly.

PROPAGATION OF WAVES

538.566 + 534.2 **2718**

Note on the Propagation of Normal Modes in Inhomogeneous Media.—L. Tolstoy. (*J. acoust. Soc. Amer.*, March 1955, Vol. 27, No. 2, pp. 274–277.) Analysis is presented for propagation in ducts with stratified media.

538.566.029.4 **2719**

More Exact Theory of Propagation of Long Electric Waves around the Earth.—J. Weidner. (*Z. angew. Phys.*, Feb. 1955, Vol. 7, No. 2, pp. 77–82.) Schumann's simplified approximation (802 and 1772 of 1953) to the general solution given by Watson (*Proc. roy. Soc. A*, 15th July 1919, Vol. 95, No. 673, pp. 546–563) is made more exact by means of an extension to two terms. The formula for the effective field strength is valid in the wavelength range from 40 to 180 km, breaking down for $\lambda < 40$ km and changing into Schumann's formula for $\lambda > 180$ km. Field-strength/distance curves are given for 40 and 130 km λ, and field-strength/wavelength curves for distances of 5 000, 7 500 and 10 000 km.

621.396.1.029.63 : 621.397.5 **2720**

U.H.F. Television Broadcasting.—Smith-Rose & Saxton. (See 2762.)

621.396.11 **2721**

Doppler Spectrum of Sea Echo at 13·56 Mc/s.—D. D. Crombie. (*Nature, Lond.*, 16th April 1955, Vol. 175, No. 4459, pp. 681–682.) A typical record of the Doppler frequency shift of radio waves reflected from the sea surface shows the frequency of the principal component to be about 0·38 c/s, irrespective of the state of the sea, and the range of frequencies to be small. An explanation of these features is presented based on the diffraction-grating effect due to the sea waves.

621.396.11 : 523.78 **2722**

Some Observations in Bratislava during the Solar Eclipse on 30th June 1954.—Šimaljak & Milerová. (See 2609.)

621.396.11 : 551.510.535 **2723**

Determination of the Energy Paths of a Wave propagated in the Ionosphere. Study of Two Particular Cases (Transparent Medium).—É. Argence. (*Ann. Géophys.*, July/Sept. 1954, Vol. 10, No. 3, pp. 249–253.) The method used gives directly the differential equations for the phase and energy paths. The case of normal incidence is discussed in detail and numerical results are given for the lateral deviation of ordinary and extraordinary rays at Freiburg and Dakar. Application of the method to propagation along the magnetic equator is dealt with briefly.

621.396.11 : 551.510.535 **2724**

Research on the Interaction and on the Self-Demodulation of Electromagnetic Waves.—E. Carlevaro. (*Ricerca sci.*, March 1955, Vol. 25, No. 3, pp. 521–531.) Work carried out at the Radio-Propagation and Radio-Navigation Study Centre at Naples is briefly surveyed, with particular attention to Cutolo's investigations of self-demodulation (see e.g. 1167 of 1954).

621.396.81 : 551.510.535 : 523.78 **2725**

On Radio Measurements at Jabalpur during the Solar Eclipse of 30th June 1954.—A. K. Ghose, K. M. Roy, S. K. Gupta, S. M. Das Gupta, V. V. Sarwate & G. K. Mithal. (*J. Instn Telecommun. Engrs, India*, March 1955, Vol. 1, No. 1, pp. 20–26.) Measurements were made of the strength and angle of incidence of 15·17-Mc/s signals from Moscow, and of the intensity of atmospheric noise on 0·6 Mc/s received from the direction of the belt of totality. The observed angle of incidence indicated two-hop transmission as the normal mode, with the second point of reflection from the F layer in the shadow belt. Rapid fluctuations of field strength around the period of the eclipse are associated with transitions from double-hop to single-hop transmission and back. The direction of the downcoming ray varied more widely during the eclipse period than during the same hours on the preceding and following days, and the atmospheric noise was higher, indicating reduction of attenuation by the E layer.

621.396.812 **2726**

An Analysis of Within-the-Hour Fading in 100- to 1 000-Mc/s Transmissions.—H. B. Janes. (*J. Res. nat. Bur. Stand.*, April 1955, Vol. 54, No. 4, pp. 231–250.) A detailed analysis is presented of measurements made during August 1952 on transmissions from sites in the Cheyenne Mountain area and at Cedar Rapids, over paths of lengths ranging from 70 to 393 miles. Fading range is defined as the ratio in decibels of the signal levels exceeded during 10% and during 90% of the hour. A special study is made of the variation of fading range with time of day and with the angular distance, defined as the angle in the great circle plane between the horizon rays from the transmitting and receiving aerials as determined for a standard atmosphere. Beyond the region where diffraction is considered to be the dominant mechanism, the signal-level distributions closely resemble the Rayleigh distribution in both fading range and general shape. Deviations from the 13·4-db fading range of a Rayleigh distribution are attributed to changes in the average signal power. See also 2399 of August (Barsis et al.).

621.396.812 **2727**

Tropospheric Refraction of Ultrashort Waves (Diurnal Variation of Field Strength).—O. Heer. (*Fernmeldetech. Z.*, March 1955, Vol. 8, No. 3, pp. 129–138.) The fine structure of the lower atmosphere is studied using meteorological data for heights of 2, 10 and 70 m; estimates are made of the resulting refraction of radio waves. Field-strength records for the 213-km Berlin/Harz u.s.w. radio link for a period of a year are compared with values calculated from the meteorological data; the observed diurnal variations of field strength are consistent with the temperature-gradient variations, but the effect of water vapour is not clear.

621.396.812.029.55 **2728**

Field-Strength Measurements in the Short-Wave Band.—J. Grosskopf. (*Fernmeldetech. Z.*, Feb. & March 1955, Vol. 8, Nos. 2 & 3, pp. 114–118 & 146–152.) Measurements reported previously (513 of 1954) were given in terms of receiver input voltage relative to 1 μV. An absolute method has since been developed; the receiver is calibrated from the known angle of arrival of the wave and the gain/angle-of-arrival characteristic of the rhombic aerial, the calculations being checked by measurements using an auxiliary local transmitter and auxiliary dipole transmitter and receiver aerials. Measurements of the strength of WWV 15-Mc/s signals received at Darmstadt over a period of a year are analysed statistically in relation to the period of the sun's rotation and to the terrestrial seasons. Comparison of the measurements with values calculated by the S.P.I.M. and C.R.P.L. methods indicates that attenuation must be caused not only by D-layer absorption but also by scattering at the surface of the earth and of the ionosphere.

621.396.812.3.029.55 **2729**

Statistical Investigations of Short-Wave Transmission Paths.—W. Kronjäger & K. Vogt. (*Fernmeldetech. Z.*, March 1955, Vol. 8, No. 3, pp. 165–167.) The validity of results of previous statistical investigations [513 of 1954 (Grosskopf)] is examined in the light of further measurements made at Eschborn on signals received from Daventry, Rome, Ankara, Cairo, New York, Tokio and Buenos Aires. The distribution of field-strength obeys a log-normal law for 98% of the observations. A well-defined value of 6 db is found for the monthly median value of the hourly scatter, and a mean value of 15 db for the scatter of the hourly median values, independent of frequency and of path length and direction.

RECEPTION

621.376.232.2 **2730**

Analysis of a Broadband Detector Circuit.—M. H. Brockman. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 715–720.) The bandwidth of a diode a.m. detector with an output circuit containing resistance shunted by capacitance is increased by inserting an inductance L of appropriate value. The detection efficiency is calculated by successive approximations, assuming first an infinite and then a finite value of L.

621.396.621 : 621.395.623.7 **2731**

Stereophonic Sound Receivers.—O. Limann. (*Electrotech. Z.*, Edn B, 21st March 1955, Vol. 7, No. 3, pp. 75–79.) Loudspeaker arrangements used in some West German commercial high-fidelity receivers are described. In addition to a large-diameter central moving-coil loudspeaker, smaller moving-coil loudspeakers are mounted so as to produce ellipsoidal equal-pressure surfaces at about 100 c/s and 8 kc/s. A l.f.

attenuator is included in the ancillary loudspeaker circuits. Experimentally determined polar sound-pressure diagrams are shown.

621.396.621.54 : 621.314.7 **2732**

A Developmental Pocket-Size Broadcast Receiver employing Transistors.—D. D. Holmes, T. O. Stanley & L. A. Freedman. (*Proc. Inst. Radio Engrs*, June **1955**, Vol. **43**, No. 6, pp. 662–670.) Details are given of the construction and performance of a superheterodyne a.m. receiver using eight junction transistors. A single transistor acts as oscillator and mixer. The overall dimensions are $5\frac{1}{8}$ in. × $2\frac{3}{4}$ in. × $1\frac{1}{4}$ in., and the weight is 17 oz.

621.396.621.54 : 621.314.7 **2733**

An Experimental Automobile Receiver employing Transistors.—L. A. Freedman, T. O. Stanley & D. D. Holmes. (*Proc. Inst. Radio Engrs*, June **1955**, Vol. **43**, No. 6, pp. 671–678.) Details are given of the construction and performance of a superheterodyne receiver using nine Ge *p-n-p* alloy-junction transistors. The current drain, including that for two pilot lights, is about a tenth of that of a conventional receiver. Particular attention has been paid to obtaining satisfactory operation over a wide temperature range.

621.396.828 **2734**

Suppression of Interference.—(*Elect. Times*, 10th March **1955**, Vol. **127**, No. 3305, p. 411.) A note on two Statutory Instruments laid before the British Parliament on 1st March 1955 and coming into force on 1st September, 1955, covering regulations to be complied with by (*a*) suppliers of refrigerators and (*b*) users of motors.

621.396.828 **2735**

How to suppress Radio Interference.—J. D. Cooney. (*Elect. Mfg*, Sept. **1954**, Vol. **54**, No. 3, pp. 109–128.) This review covers (*a*) U.S.A. regulations, (*b*) sources of interference, (*c*) measurement, and (*d*) suppression. Methods of reducing interference by means of suitable design of equipment are particularly stressed. The equipment considered includes electrical motors, switches and regulators as well as various mechanical-drive elements where interference may be produced by discharge of the large electrostatic charges built up by friction.

STATIONS AND COMMUNICATION SYSTEMS

621.376.3 : 621.396.822 **2736**

The Power Spectrum of a Carrier Frequency-Modulated by Gaussian Noise.—R. G. Medhurst: J. L. Stewart. (*Proc. Inst. Radio Engrs*, June **1955**, Vol. **43**, No. 6, pp. 752–754.) Critical comment on 259 of January and author's reply.

621.376.5 : 621.39 **2737**

Pulse Slope Modulation—a New Method of modulating Video Pulses and its Possible Application on Line Circuits.—J. Das. (*Indian J. Phys.*, Oct. **1954**, Vol. **28**, No. 10, pp. 449–462.) Pulse-slope modulation is achieved by applying a rectangular gating pulse to an integrating circuit, the charging current to the integrating capacitor being made to vary with signal voltage. Demodulation is performed by differentiating the slope-modulated pulses and passing the resulting pulses through a memory circuit and low-pass filter. Successful transmission has been achieved over a 100-mile open-wire circuit. Signal/noise ratio and modulation linearity are satisfactory; the system may be useful for time-division multiplex.

621.376.5 : 621.39 **2738**

Pulse Space Modulation.—G. X. Potier. (*Onde élect.*, Feb. **1955**, Vol. **35**, No. 335, pp. 159–164.) A variation of p.p.m. in which the position of any pulse in one channel of a multiplex system is determined by the instantaneous values of the signals in the other channels. In a given bandwidth four times as many communication channels can be accommodated as in a normal p.p.m. system. Liability to crosstalk is eliminated by the use of storage devices.

621.376.5 : 621.396.41 **2739**

A 24-Channel Pulse-Time Modulation System.—R. F. B. Speed. (*Proc. Instn elect. Engrs*, Part B, May **1955**, Vol. **102**, No. 3, pp. 375–382.) A system for use with a 2-kMc/s radio link is described.

621.39.001.11 **2740**

On the Definition of Entropy in Information Theory.—A. Tortrat. (*Ann. Télécommun.*, Feb. **1955**, Vol. **10**, No. 2, pp. 39-47.) From the definition of entropy based on a coordinate system representing the number of degrees of freedom, two different expressions are obtained in information theory according as the distribution considered is continuous or discontinuous. The restrictions on applying the definition generally adopted for the former case are examined and functions are discussed applicable in defining entropy when the number of parameters is infinite.

621.39.001.11 **2741**

Coding for Constant-Data-Rate Systems: Part 2—Multiple-Error-Correcting Codes.—M. Balser & R. A. Silverman. (*Proc. Inst. Radio Engrs*, June **1955**, Vol. **43**, No. 6, pp. 728–733.) Continuation of the study described previously [3674 of 1954 (Silverman & Balser)]. A simple pulse model of the system is presented which is easier to visualize than the correlation-detection scheme. The Wagner code is extended to two multiple-error-correcting schemes. The efficiency of the Wagner code is evaluated by comparing it with Shannon's ideal coding.

621.39.001.11 : 519.2 **2742**

Information, Selection, Selective Information. Is Certainty a Universal Constant?—M. Laloë. (*Ann. Télécommun.*, Feb. **1955**, Vol. **10**, No. 2, pp. 31–38.) Discussion, with reference to probability theory [1724 of 1952 (Woodward & Davies)], of a definition of information equivalent to entropy; selection is defined as an operation consuming information in accordance with the risk of error. By assessing a communication system on a cost/time basis results are brought into line with those of Shannon's theory.

621.394 **2743**

Functional-Diagram Approach to Electronics in Telegraphy.—E. P. G. Wright & D. S. Ridler. (*Elect. Commun.*, March **1955**, Vol. **32**, No. 1, pp. 26–42.) Functional diagrams developed in connection with digital computers are explained and applications to telegraph systems are illustrated. Counter, gating and trigger circuits, and applications for avoiding the effects of interference, are discussed. Error indicating and correcting systems which do not require the use of signal storage are based on the fact that a large percentage of all errors are isolated and may be corrected automatically. Such a system is described in detail. Storage systems have advantages in flexibility and control and may be desirable on economic grounds.

621.395.44 **2744**

Construction of the Carrier-Frequency System Z12N: a System for Short- and Long-Distance Communication.—O. Schmitt, R. Stecher & W. Zitzmann. (*Frequenz*, Feb. 1955, Vol. 9, No. 2, pp. 33–41.)

621.396 **2745**

The Argentine Telecommunication Network.—H. B. R. Boosman. (*Commun. News*, March 1955, Vol. 15, No. 3, pp. 60–70.) A radio network for telegraph and telephone traffic is being set up for use during extensive line modernization. H.f. s.s.b. connection between Buenos Aires and the more important inland towns will be provided. There will also be zonal networks, rural networks and press and mobile maritime services.

621.396 : 621.376 **2746**

A Phase-Rotation Single-Sideband Generating System.—J. R. Hall. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 43–51.) A system is described in which a single control in one phase branch of the a.f. modulating circuit is used to maintain the amount of sideband suppression constant when the output frequency is varied.

621.396.3/.5 (931) **2747**

A Survey of Radio Progress in the New Zealand Post Office.—G. Searle. (*Radio elect. Rev., Wellington, N.Z.*, 1st Feb. 1955, Vol. 9, No. 12, pp. 33–35..50 & 1st March 1955, Vol. 10, No. 1, pp. 36–39.) Text of a recent conference address outlining important developments since 1944 and covering frequency allocations and the production of crystals, and long-distance and short-distance communication services including a microwave system. Equipment operated by the Air and Marine Departments, and Post Office equipment for inspection and measurement are noted.

621.396.712 **2748**

Spurious Radiation from Wrotham.—J. R. Brinkley. (*Wireless World*, July 1955, Vol. 61, No. 7, p. 325.) Cases of unwanted radiation, particularly of third-order intermodulation products, due to direct coupling between co-sited transmitters sharing an aerial are reported. The importance of using separate aerials, suitably spaced to avoid this trouble, is emphasized. A letter from Pawley (*ibid.*, Aug. 1955, Vol. 61, No. 8, p. 367) points out that the fault discussed will not arise with the Wrotham installation in its final form.

621.396.712 : 621.376.3 **2749**

Inauguration of V.H.F.-F.M. Service in Great Britain. (*J. Brit. Instn Radio Engrs*, May 1955, Vol. 15, No. 5, pp. 269–270.) The station networks under construction and under consideration are briefly indicated, and some details are given of the transmitting equipment at Wrotham.

621.396.97 **2750**

Sound Broadcasting in North America.—R. H. Tanner. (*J. Instn elect. Engrs*, June 1955, Vol. 1, No. 6, pp. 341–346.) A survey indicating how the existing stage of development has been influenced by the earlier stages.

SUBSIDIARY APPARATUS

621-526 **2751**

Time-Scale and Gain Influence on Servo Performance.—D. Graham & R. C. Lathrop. (*Trans. Amer. Inst. elect. Engrs*, Part II, *Applications and Industry*, July 1954, Vol. 73, pp. 173–178. Digest, *Elect. Engng, N.Y.*, Nov. 1954, Vol. 73, No. 11, p. 995.) The criterion previously applied in determining normalized transfer function coefficients (2433 of August) can also usefully be applied in the selection of optimum gain or time scale for second- or third-order servomechanisms.

621-526 : 519.272 **2752**

The Use of Correlation Techniques in the Study of Servomechanisms.—T. M. Burford, V. C. Rideout & D. S. Sather. (*J. Brit. Instn Radio Engrs*, May 1955, Vol. 15, No. 5, pp. 249–257.)

621-526 : 621.387 **2753**

The Dynamic Behaviour of Servomechanisms using Thyratrons.—P. Bonnet. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 97–104.) If the response of the servomechanism is linear the self-inductance of the motor armature may be ignored in calculating the transfer constant of the system for discontinuous operation; in continuous operation it must be taken into account. A method of calculating the transfer function is presented for the general case of nonlinear operation, but the formulae involved are cumbersome and an experimental approach may be preferable.

621.311.6 : 621.314.7 **2754**

The Economics of the Transistor D.C. Transformer.—G. Grimsdell. (*Electronic Engng*, June 1955, Vol. 27, No. 328, pp. 268–269.) H.v. supply units using power junction transistors are compared with conventional h.v. sources.

621.314.63 : 546.824-3 **2755**

Electrical Properties of Titanium Dioxide Rectifiers.—T. S. Shilliday & C. S. Peet. (*Elect. Mfg*, Sept. 1954, Vol. 54, No. 3, pp. 102–105.) Results obtained are similar to those reported earlier by Breckenridge & Hosler (229 of 1953). The conversion efficiency of a Bi-TiO_2 rectifier remained constant during operation for 515 h at 125°C and during most of the 320-h test at 150°C, but decreased rapidly during operation at 200°C, failure occurring after 60 h. The spread of the rectification characteristics of 92 Bi-TiO_2 rectifiers is presented graphically, as well as the distribution of peak dynamic current/voltage characteristics in 54 specimens.

621.316.721 **2756**

A Precision Direct-Current Stabilizer.—M. W. Jervis. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 274–277. Discussion, pp. 277–278.) "A d.c. stabilizer is described which delivers 50–150 mA stable to a few parts in 10^6. A degenerative feedback system is used with a contact-modulator amplifier, self-oscillation being prevented and the frequency response improved by an auxiliary a.c. feedback loop. Facilities for monitoring the stability are provided."

621.316.722.1 : 621.3.027.3.029.5 **2757**

A Voltage Stabilizer for a Radio-Frequency Extra-High-Tension Set.—R. B. D. Knight, K. M. Poole & J. H. Sanders. (*J. sci. Instrum.*, April 1955, Vol. 32, No. 4, pp. 134–136.) The voltage to be stabilized is applied across a 250-MΩ bank of resistors, and a fraction is balanced against a 120-V reference voltage, the difference being converted, in a circuit comprising two valves Type 12SA7, to a 2-kc/s signal which is amplified, rectified in a phase-sensitive circuit, and applied to control the screen voltage of the main oscillator. Curves show the variation with load current up to 450 μA for nominal output voltages of 7·5, 10, 15 and 20 kV.

621.316.722.1 : 621.311.6 **2758**

Heavy-Duty, High-Stability D.C. Power Supplies.—D. M. Neale. (*J. Brit. Instn Radio Engrs*, May 1955, Vol. 15, No. 5, pp. 271–280.) "Series-valve stabilizers are considered as a simple step-by-step development of the cathode follower. By shunting a resistor or barretter across the series valve, substantially constant loads of several amperes can be stabilized to ± 0·01 per cent. . . . Full circuits are given of two typical units providing outputs of 250 and 500 watts with efficiencies of 35 and 65 per cent. respectively. The latter includes a device providing audible warning when supply-voltage variations exceed the range stabilized automatically."

621.316.722.1 : 621.311.6.027.3 : 621.385.833 **2759**

The Use of an Electron Velocity Analyser to Stabilize a 50-kV Direct-Voltage Source to a Few Parts in a Million.—M. E. Haine & M. W. Jervis. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 265–273. Discussion, pp. 277–278.) A degenerative-feedback stabilizer circuit is used in which the signal to the feedback amplifier is obtained by accelerating a beam of electrons by the voltage to be stabilized and measuring the velocity by deflection in a fixed magnetic field. Much larger signals can be obtained in this way than by use of the usual resistance-type potential divider.

TELEVISION AND PHOTOTELEGRAPHY

621.397.5 **2760**

The 625-Line C.C.I.R. System: an Investigation by a Mobile Laboratory.—D. Bauer, E. Ribchester & G. B. Townsend. (*J. Telev. Soc.*, Jan./March 1955, Vol. 7, No. 9, pp. 369–377.) Tests on a British-designed 625-line receiver were made in Holland. The results indicated that (*a*) positive modulation is preferable to negative, (*b*) a 625-line system is a useful compromise as between quality and cost, (*c*) f.m. is desirable provided the deviation is not less than about 50 kc/s, (*d*) there is little to choose between horizontal and vertical polarization, (*e*) nonsynchronous mains operation may be desirable from the point of view of international programme exchanges, but may lead to more costly receivers.

621.397.5 : 535.623(083.71) **2761**

I.R.E. Standards on Television: Definitions of Color Terms, 1955.—(*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 742–748.) This Standard, 55 IRE 22.S1, is an expanded and revised version of one presented previously (1817 of 1953).

621.397.5 : 621.396.1.029.63 **2762**

U.H.F. Television Broadcasting.—R. L. Smith-Rose & J. A. Saxton. (*Wireless World*, July 1955, Vol. 61, No. 7, pp. 343–346.) From experimental evidence it is inferred that in mixed urban and rural areas a range of 60 km obtained on a frequency of 50 Mc/s will be reduced to 30 km on 500 Mc/s for equal effective radiated power, or to 36 km with a tenfold increase in power; the type of polarization of the radiated waves does not affect the received field strength.

621.397.5 : [778.5 + 621.395.625 **2763**

A Short History of Television Recording.—A. Abramson. (*J. Soc. Mot. Pict. Telev. Engrs*, Feb. 1955, Vol. 64, No. 2, pp. 72–76.) A review of past and present techniques including notes on magnetic recording systems for monochrome and colour television and the application of television techniques in kinematography.

621.397.5 : 778.5 **2764**

Recording Television Pictures on Cinematograph Film.—R. Theile & A. Brosch. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 141–154.) Known methods for operating with continuous or intermittent film motion are discussed and their suitability for operation with different television standards compared. An experimental arrangement for suppressed-frame recording on 16-mm film is described; this uses spot wobbling to eliminate the line structure revealed by blanking out alternate frames. In considering the further development of recording systems, attention is directed to the advantages of picture storage with long-persistence fluorescent screens, and of medium-fast pull-down with intermittent film motion.

621.397.6 **2765**

Combat Television.—E. L. Scheiber & H. C. Oppenheimer. (*J. Soc. Mot. Pict. Telev. Engrs*, March 1955, Vol. 64, No. 3, pp. 129–132.) Requirements for a transportable television unit for military operations are discussed. Successful demonstrations staged in 1954 using standard broadcast-type and airborne equipment showed 525-line definition to be adequate.

621.397.6 : 535.317.001.4 **2766**

Equipment for Evaluating Lenses of Television Systems.—E. Hutto, Jr. (*J. Soc. Mot. Pict. Telev. Engrs*, March 1955, Vol. 64, No. 3, pp. 133–136.) Description of a test bench with c.r.o. equipment for rapid determination of the response of lenses, of focal length up to 24 in., at different apertures and field angles.

621.397.6 : 621.397.8 **2767**

Control of [brightness] Levels in Television Transmission Installations.—W. Dillenburger. (*Frequenz*, Feb. 1955, Vol. 9, No. 2, pp. 42–49.) Brightness control in a negative-modulation system is discussed in which the black level is kept constant both at the transmitter and the receiver and the white level is controlled by a.g.c. This produces less distortion of brightness gradation than a limiter system. A suitable circuit is given.

621.397.6.001.4 **2768**

Testing International Television Transmission Lines.—J. Müller & E. Demus. (*Fernmeldetech. Z.*, March 1955, Vol. 8, No. 3, pp. 141–143.) Procedure and equipment developed in Germany for testing the performance of television links under operating conditions are briefly described. A sawtooth voltage is used for adjusting levels and checking linearity, and a square-wave voltage for testing transient response.

621.397.6.001.4 **2769**

Video-Frequency Signal-Level Measurements on Television Transmissions.—H. Bödeker. (*Fernmeldetech. Z.*, March 1955, Vol. 8, No. 3, pp. 143–145.) C.r.o. equipment and procedure developed by the Federal German Post Office are described. The voltages under test are compared with an adjustable known direct voltage by rapid commutation.

621.397.62 : 535.623 **2770**

Simplified RCA Color Receiver.—W. H. Buchsbaum. (*Radio & Telev. News*, March 1955, Vol. 53, No. 3, pp. 37–39, 124.) The circuits used in this 28-valve television receiver are briefly described, with emphasis on new features. Circuit diagrams given include one of the double-triode demodulator which supplies the colour-difference voltages to the 21-in. three-gun c.r. tube.

621.397.621.2 : 535.623 : 621.385.832 **2771**

Development of a 21-Inch Metal-Envelope Color Kinescope.—H. R. Seelen, H. C. Moodey, D. D. VanOrmer & A. M. Morrell. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 122–139.) The Type-21AXP22 shadow-mask tube is described in some detail.

621.397.621.2 : 535.623 : 621.385.832 **2772**

Deflection and Convergence of the 21-Inch Color Kinescope.—M. J. Obert. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 140–169.) Details are given of the deflection and convergence systems for the Type-21AXP22 tube. The method used to investigate the field distribution of the deflection yoke is described. Typical performance data are presented.

TRANSMISSION

621.396.61 : 621.373.42 **2773**

A Variable-Frequency Drive of High Stability for Aircraft Use.—T. T. Brown. (*Marconi Rev.*, 1st Quarter 1955, Vol. 18, No. 116, pp. 8–20.) Difficulties in the design of aircraft transmitters, due to exacting physical conditions, are overcome by an equipment in which the output of an *LC* oscillator is mixed with that of an 11-step crystal oscillator and followed by a frequency multiplier to give a range of 2–12 Mc/s. The first models produced had an average temperature coefficient of $\pm$ 2 parts in 10^6 per °C over the temperature range -40°C to $+55$°C. The tuning scale enables frequencies to be set with an error of the order of 1 part in 10^4. Production of spurious frequencies in the mixer stage is reduced by the choice of appropriate frequency ratios and other precautions.

621.396.66 : 621.316.726 **2774**

Automatic Frequency Control for Centimetre-Wave Communication Transmitter.—J. Cayzac. (*Onde élect.*, Feb. 1955, Vol. 35, No. 335, pp. 151–158.) Two resonant cavities tuned to symmetrically offset frequencies are sampled alternately by a crystal detector whose output provides a control voltage for maintaining, to an accuracy of one part in 10^5, the frequency of the oscillator, which may be either frequency or amplitude modulated. The frequency-determining and -correcting elements may be mounted together in a position remote from the power-consuming parts of the system.

VALVES AND THERMIONICS

621.314.63 **2775**

A Possible Explanation of Flicker Effect in Crystal Rectifiers.—N. Nifontoff. (*C. R. Acad. Sci., Paris*, 25th April 1955, Vol. 240, No. 17, pp. 1695–1697.) An explanation consistent with experimental results obtained previously (1047 of 1953) is based on fluctuations of currents across the potential barrier due to generation and recombination of carriers. See also 2643 above.

621.314.63 : 537.311.33 **2776**

Rectifiers with *p-i-n* or *p-s-n* Structure under D.C. Loading.—A. Herlet & E. Spenke. (*Z. angew. Phys.*, Vol. 7, Feb.-April 1955, Nos. 2-4, pp. 99–107, 149–163 & 195–212.) Rectifiers with an intrinsic-conduction intermediate layer (*p-i-n*), discussed earlier by Prim (2689 of 1953), and those with a 'soft' intermediate layer (*p-s-n*), having an impurity-introduced carrier concentration of the order of 10^{-3} times that of the *n* or *p* layers, are considered theoretically with particular reference to their behaviour under conditions of no-load, light forward or blocking load, and heavy blocking load. The *p-i-n* type is considered to be a physically unattainable limiting case.

621.314.63 : 546.28 **2777**

A Method of making Silicon Junction Diodes.—J. W. Granville. (*Brit. J. appl. Phys.*, March 1955, Vol. 6, No. 3, p. 109.) Brief details are given of a *p-n* junction diode made by oxidizing the surface of a Si crystal, pressing a probe of suitable material on to the oxide layer, and passing a short pulse of large amplitude through the contact so that the oxide layer is pierced and the probe is welded to the crystal.

621.314.63 : 621.396.822 **2778**

Experimental Confirmation of the Schottky Noise Formulae for Recently Developed Semiconductor Junction Diodes over the White-Noise [frequency-independent noise] **Spectrum.**—W. Guggenbühl & M. J. O. Strutt. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 103–108.) Formulae for the available noise power, derived from Schottky's equation for the saturated thermionic diode, on the assumption of two uncorrelated noise currents, associated respectively with forward and reverse junction currents, are found to be valid for the frequency range from about 1 kc/s upwards over which the noise is frequency independent. Measurements are reported of the current dependence and frequency dependence of noise in point-contact and junction diodes; the difference between the frequency dependent characteristic at low a.f. and the frequency independent characteristic at the higher frequencies is observed.

621.314.7 **2779**

Stabilizing Transistors Against Temperature Variations.—S. Sherr & T. Kwap. (*Tele-Tech & Electronic Ind.*, March 1955, Vol. 14, No. 3, pp. 74–76 . . 147.) Application of direct-coupled feedback enables the operating temperature range of transistors to be extended by as much as 40°C.

621.314.7 **2780**

Diffusion Capacitances and High-Injection-Level Operation of Junction Transistor.—T. Misawa. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 749–750.) Calculations are made of the diffusion capacitances. Even at high injection level the ratio of collector-junction diffusion capacitance to depletion-layer capacitance serves as a measure of injection level.

621.314.7 **2781**

Delayed Collector Conduction, a New Effect in Junction Transistors.—M. C. Kidd, W. Hasenberg & W. M. Webster. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 16–33.) Examination of the family of I_e/V_e characteristics of junction transistors for a wide range of values of base current I_b indicates that, in the regions where I_b exerts a blocking influence on emitter current, collector current cannot flow until collector voltage reaches a certain value; this is the 'delayed collector conduction' effect. The I_e/V_e characteristic rises steeply, with positive slope over part of the region and negative slope over the remainder. The transistor then has high input impedance and low output impedance. Theory of the effect is discussed and applications in amplifiers, voltage regulators and switching devices are described.

621.314.7 : 537.311.33 **2782**

Comparative High-Frequency Operation of Junction Transistors made of Different Semiconductor Materials.—L. J. Giacoletto. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 34–42.) Discussion indicates that mobilities of minority and majority carriers have about equal influence on the high-frequency performance of junction transistors; hence the *n-p-n* type should give about the same performance as the geometrically identical *p-n-p* type. The suitability of semiconductors for use in transistors can be assessed in terms of a figure of merit given by the product of the two drift mobilities divided by the square root of the dielectric constant.

621.314.7 : 621.375.4 **2783**

Transistor Circuit Analysis.—B. Millar. (*Wireless Engr*, July 1955, Vol. 32, No. 7, p. 196.) Formulae for the operating impedances are derived from consideration of the equivalent circuits for earthed-base, earthed-emitter and earthed-collector amplifiers.

621.314.7.001.4 **2784**

The Measurement and Display of the Current Gain (α) of a Transistor as a Function of Emitter Current.—R. A. Hilbourne. (*J. sci. Instrum.*, March 1955, Vol. 32, No. 3, pp. 83–85, 87.) C.r.o. apparatus is described, with particular reference to the amplifier bandwidth requirements for the accurate display of the rapid variations of α.

621.383 **2785**

Calculation of Radiant Photoelectric Sensitivity from Luminous Sensitivity.—R. W. Engstrom. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 116–121.)

621.383.2 : 537.311.33 **2786**

Variation of the Conductivity of the Semitransparent Cesium-Antimony Photocathode.—W. Widmaier & R. W. Engstrom. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 109–115.) The response of photocells with this type of cathode may be limited at low and even at normal temperatures by the resistance of the cathode. The conductivity falls while the cell is out of use but recovers during operation.

621.385.001.4 **2787**

An Inflection-Point Emission Test.—E. G. Hopkins & K. K. Shrivastava. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 707–711.) A rapid method of testing valves is described in which a single triangular current pulse is passed through the valve and the anode voltage is differentiated twice; the time taken for the second differential to reach zero is indicated on a meter calibrated to give a direct reading of the inflection-point emission. In the experimental equipment used, the pulse current varied at a rate of 4 A/ms. It is suggested that tests of this type would be useful for investigating emission variations during operation, even if the particular valve has no definite inflection point at the normal operating temperature of the cathode.

621.385.001.4 **2788**

Subminiature-Tube Reliability Testing.—S. Bickel. (*Elect. Commun.*, March 1955, Vol. 32, No. 1, pp. 11–18.) Description of acceptance tests on valves used in applications such as guided missiles where mechanical stresses are high. In the vibration test tubes are subjected to an acceleration of 15*g*, at 40 c/s. Emphasis is placed on microscope inspection, and a series of photographs shows typical faults detected in this way.

621.385.002.2 **2789**

Thermionic Valves of Improved Quality for Government and Industrial Purposes.—E. G. Rowe, P. Welch & W. W. Wright. (*Proc. Instn elect. Engrs*, Part B, May 1955, Vol. 102, No. 3, pp. 343–357. Discussion, pp. 357–363.) Reliability requirements of valves for computers, aircraft equipment, etc. are discussed. Work done on the design of valves to give trouble-free service under conditions of vibration and shock is described. Future trends are outlined. 102 references. For a short progress report see also *Wireless World*, Jan. 1955, Vol. 61, No. 1, pp. 18–20.

621.385.029.6 **2790**

Backward-Wave Oscillators.—H. R. Johnson. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 684–697.) "The Pierce traveling-wave tube theory is modified to apply to the backward-wave oscillator. Theoretical dependence of both starting current and frequency upon space charge and circuit loss is calculated, as is the dependence of efficiency upon these parameters. Good experimental confirmation is obtained with two tubes, one of which was of adjustable length. Pushing, pulling, stability, frequency gaps, and spurious oscillations are described and explained. Lack of oscillation at low-voltage end of tuning range of some tubes is tentatively assigned to a velocity-distribution effect."

621.385.029.6 **2791**

Amplification of the Traveling-Wave Tube at High Beam Current.—S. Olving. (*Chalmers tek. Högsk. Handl.*, 1955, No. 157, 11 pp. In English.) A method for evaluating the gain explicitly as a function of the valve parameters is based on solutions of the equation for the wave propagation constants involving asymptotic expansions of the modified Bessel functions for large arguments. The solutions are valid only when the beam circumference is large compared with the axial wavelength. When the beam is in step with the unperturbed helical wave, the gain is $\propto i_0^{1/3}$ for small values of beam current i_0; as i_0 increases the gain becomes independent of its value over a wide range; for high values of i_0 the gain is $\propto i_0^{-1/2}$. This result is compared with that of Friedman (2579 of 1951).

621.385.029.6 : 621.317.329 **2792**

A Proposed Method of investigating the Field Distribution in a Magnetron.—A. W. Aikin. (*J. sci. Instrum.*, April 1955, Vol. 32, No. 4, p. 152.) A rotating cathode is fitted with a disk at each end, and two thin fibres stretched between the disks support a small dielectric needle of high permittivity. The deviation of the resonance frequency of the cavity is proportional to the square of the component of electric field strength in the direction of the needle. A complete plot can be made of the field in the anode bore.

621.385.029.6 : 621.318.2 **2793**

Optimum Design of Periodic Magnet Structures for Electron-Beam Focusing.—K. K. N. Chang. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 65–81.) Design curves are given for ring magnets combining low weight with maximum focusing effect. Results of some measurements are compared with calculated data.

621.385.029.6 : 621.396.822 **2794**

Correlation Conditions for the Shot Effect.—H. W. König. (*Arch. elekt. Übertragung*, March 1955, Vol. 9, No. 3, pp. 109–116.) The experimental results obtained by Cutler & Quate on noise in electron beams (1274 of 1951) have been interpreted on the assumption that under space-charge conditions there are uncorrelated noise contributions due to a velocity fluctuation and a current fluctuation at the potential minimum. This view cannot be reconciled with the theory developed by Rack (*Bell Syst. tech. J.*, Oct. 1938, Vol. 17, No. 4, pp. 592–619). Better agreement is established on the assumption of partial correlation between the two contributions. A value is determined for the real part *r* of the complex correlation factor. The product of maximum and minimum noise-current values investigated by Pierce (304 of January) is independent of r but is dependent on the imaginary part of the correlation factor.

621.385.029.6 : 621.396.822 **2795**

Theory of Frequency-Modulation Noise in Tubes employing Phase Focusing.—J. L. Stewart. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 409–413.) Discussion of noise resulting from fluctuations in magnetron oscillation frequency due to random distribution of electron velocities. The noise bandwidth is estimated. The theory is applied to a particular wide-band magnetron.

621.385.029.63 **2796**

A Medium-Power Travelling-Wave Tube for 2,000 Mc/s.—R. B. Coulson & F. N. H. Robinson. (*Marconi Rev.*, 2nd Quarter 1955, Vol. 18, No. 117, pp. 48–59.) Description of design and construction of valve Type N1001. Low-level gain is > 40 db with an operating voltage of 2 200 V and 40 mA beam current; saturation output power is 20 W, with 2 600 V.

621.385.032.21 **2797**

Field Emission from Rhenium: Emission Pattern corresponding to Hexagonal Crystal Structure.—G. Barnes. (*Phys. Rev.*, 15th March 1955, Vol. 97, No. 6, pp. 1579–1583.) Initial results are reported of a study of rhenium needle-shaped cathodes. Some advantages over tungsten are noted.

621.385.032.213 **2798**

Ionic Bombardment Heating of Magnetron Cathodes.—A. E. Barrington. (*Brit. J. appl. Phys.*, March 1955, Vol. 6, No. 3, pp. 96–98.) A method is described in which hydrogen from a heated replenisher, consisting of an indirectly heated Ni pellet coated with a suspension of zirconium hydride, is introduced into the valve. A low-pressure gas discharge is initiated and the cathode is heated by positive-ion bombardment. When the cathode temperature reaches the level required for operation, the hydrogen is reabsorbed by the replenisher.

621.385.032.216 **2799**

On the Electron Bombardment Effect for Deposited Barium Oxide Films.—T. Imai. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, p. 1037.) Correction to paper abstracted in 2819 of 1954.

621.385.032.216 **2800**

On the Electron Bombardment Effect for Deposited Barium Oxide Films: Part 2.—T. Imai & Y. Mizushima. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 1032–1034.) Continuation of work reported previously [2819 of 1954 (Imai)]. The film containing an extremely small quantity of free Ba showed a large increase in emission under bombardment, while the film containing a large quantity of free Ba showed a marked tendency to deactivation. The temperature effect and its inhibition are also considered.

621.385.032.216 **2801**

Effect of the Base Metal on the Electron Dissociation of Deposited Barium Oxide Films.—T. Imai & N. Shibata. (*J. Phys. Soc. Japan*, Nov./Dec. 1954, Vol. 9, No. 6, pp. 1034–1035.) Measurements were made on films deposited on Ti and Ni anodes under electron bombardment. A greater evolution of gas and higher rate of release of Ba atoms were observed from the Ti anode.

621.385.2 + 621.385.029.6 **2802**

Electron Temperature in the Parallel Plane Diode.—T. N. Chin. (*J. appl. Phys.*, April 1955, Vol. 26, No. 4, pp. 418–423.) Analysis is based on introduction of a relaxation time defined previously in work on stellar clouds. The electron flow is designated as isotropic if the relaxation time t_R is very much smaller than the mean electron transit time t_T and anisotropic if $t_T \ll t_R$. Equations are derived expressing the velocity dependence of the electron temperature for both types of flow; in the parallel plane diode the electron temperature along the flow decreases as the mean electron velocity increases. The theory is applied to the case of a travelling-wave-valve under conditions assumed by Parzen & Goldstein (2580 of 1951).

621.385.3.032.24.029.6 **2803**

Producing Formed and Inside-Out Grids for U.H.F. Pencil Tubes.—H. J. Ackerman. (*Electronics*, May 1955, Vol. 28, No. 5, pp. 270..278.) To ensure that the grid-cathode spacing is not limited by the thickness of the supports, the grid wires are either formed against an internal mandrel so as to encircle the supports, or else wound directly on the mandrel with the supports placed outside.

621.385.832 + 621.383.2 **2804**

An Electron Tube for High-Speed Teleprinting.—W. H. Bliss & J. E. Ruedy. (*RCA Rev.*, March 1955, Vol. 16, No. 1, pp. 5–15.) The tube described combines features of the image converter with those of the ordinary c.r. tube, and simulates electronically the operations of selecting type characters from a font and arranging them in lines. The characters are on a slide which is projected on to the photoemissive cathode and reproduced on a fluorescent screen which can be photographed. The cross-sectional region of the beam corresponding to a desired character is selected by magnetic deflection controlled by a coded input; a second deflection system controls the arrangement of the characters on the screen. A line of 150 characters is considered feasible.

621.387 : 537.531 **2805**

X-Ray Emission from High-Voltage Hydrogen Thyratrons.—S. Schneider & B. Reich. (*Proc. Inst. Radio Engrs*, June 1955, Vol. 43, No. 6, pp. 711–715.) Beam pattern, energy and intensity are investigated for the X rays emitted by three types of thyratron during the breakdown of pulses and as a result of grid emission between pulses.

621.387 : 621.318.57 **2806**

Reversible Dekatron Counters.—Branson. (See 2550.)

MISCELLANEOUS

413 = 20 = 50 **2807**

Technical Dictionary English-Italian Italian-English. [Book Review]—G. Marolli. Publishers: F. Le Monnier, Florence, 1954, 5th edn revised and extended, 1075 pp., 7500 L. (*Alta Frequenza*, Feb. 1955, Vol. 24, No. 1, pp. 86–87.)

621.3.049.7 **2808**

Automation at Work in Production of Electronic Equipment.—(*Elect. J.*, 10th June 1955, Vol. 154, No. 23, pp. 1848–1850.) A description of the National Bureau of Standards Tinkertoy production system. See also 693 of 1954 (Henry & Rayburn).

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2-8 2809

Absorption and Velocity of Ultrasonic Waves of Finite Amplitude in Liquids.—D. M. Towle & R. B. Lindsay. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 530–533.) Measurements have been made of the absorption and velocity as a function of the intensity. Results are reported for propagation in distilled water and dilute solutions of acetic acid and sodium acetate and for glycerine, using frequencies from 4 to 9 Mc/s. Absorption was observed to vary but velocity remained unchanged.

534.2-8 2810

Phase Velocity and Absorption Measurements in Water containing Air Bubbles.—F. E. Fox, S. R. Curley & G. S. Larson. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 534–539.) Measurements were made of the phase velocity and absorption at frequencies from 10 kc/s to 1 Mc/s. Phase velocity varied from 500 m/s to 2 500 m/s and peak absorption was $>$ 30 db/cm with the bubbles constituting 0·02% of the volume.

534.2-8 2811

Attenuation of Ultrasound in Aqueous Suspensions.—V. J. Stakutis, R. W. Morse, M. Dill & R. T. Beyer. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 539–546.) Measurements were made using ultrasonic pulses of frequency between 15 and 30 Mc/s in suspensions of lycopodium spores and of a quartz sand at various concentrations. The attenuation constant varies linearly with the concentration over the range investigated.

534.232 + 538.566 2812

Relation between the Intensity Distributions over Radiating Systems and their Directivity Characteristics.—Eckart. (See 2923.)

534.232-8 2813

Design of Large Variable Resonant Frequency Transducers.—F. J. Fry, F. Dunn & W. J. Fry. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 570–575.) A transducer is described comprising a plane array of piezoelectric elements coupled to a mercury column of variable length. The system is enclosed in a steel tank with a rubber window for underwater use; it is capable of providing high acoustic power over a wide frequency range. See also 2319 of 1951 (Hall & Fry).

534.24 : 551.596.1 2814

Echoes in Forests.—N. V. Ivashchenko. (*Priroda, Moscow*, March 1955, Vol. 44, No. 3, pp. 117–118.) The duct effect and sound echoes observed in woods are probably due to reflections at a layer of warmer air above and around the wood; such a layer would be produced by the sun, in the absence of high winds.

534.414 2815

Theory of Arbitrary Systems of Weakly Coupled Acoustic Resonators.—E. Christian. (*Acustica*, 1955, Vol. 5, No. 2, pp. 119–130. In German.) First-order perturbation theory is used. The frequency splitting caused by volume deformation is calculated as well as that resulting from detuning due to the coupling spaces. The coupling frequencies are found as solutions of a secular determinant whose elements are composed of energy terms.

534.61 : 534.79 2816

Testing and Calibration of Commercial Phonmeters with Particular Reference to Measurements of Traffic Noise.—S. Kitsopoulos. (*Bull. schweiz. elektrotech. Ver.*, 16th April 1955, Vol. 46, No. 8, pp. 372–376, 389.)

534.614-8 2817

Dispersion of Ultrasonic Pulse Velocity in Cylindrical Rods.—L. Y. Tu, J. N. Brennan & J. A. Sauer. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 550–555.) Measurements were made of the velocity of compression and shear waves in rods of Al alloy, brass, Cu and steel with diameters from $\frac{1}{8}$ to 1 in., using pulses with carrier frequencies of 200, 400, 1 000 and 2 500 kc/s. With compression waves the velocity depends on the ratio between rod radius a and λ, its value practically reaching that appropriate to the bulk material when $a/\lambda = 2{\cdot}5$. No such dispersion is observed with shear waves.

534.75 2818

The Reception of Repeated and Overlapping Speech Patterns.—J. W. Black. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 494–496.) Experiments are reported on the effect on intelligibility of presenting speech syllables almost simultaneously via a direct channel and via a variable-delay channel. With the delay varied by 0·03-sec steps up to 0·33 sec, intelligibility was in all cases lower than for the direct signal alone.

534.75 **2819**
Statistical Study of Differential Auditory Sensitivity in relation to Intensity.—R. Chocholle. (*Acustica*, 1955, Vol. 5, No. 2, pp. 134–141. In French.)

534.78 **2820**
Development of a Quantitative Description of Vowel Articulation.—K. N. Stevens & A. S. House. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 484–493.)

534.78 : 534.4 **2821**
A Difference Limen for Vowel Formant Frequency.—J. L. Flanagan. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 613–617.)

534.851 : 681.85 **2822**
Calibration of Test Records by Interference Patterns.—B. B. Bauer. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 586–594.)

534.86 : 621.395.625.3 : 621.318.13 **2823**
Alloy improves Magnetic Recording.—C. W. Lufcy & W. T. Heath. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 137–139.) Recording and reproducing heads made from cold-rolled alfenol [2456 of 1954 (Nachman & Buehler)] have been investigated; they have high wear resistance and resolution and low losses, all important advantages for handling video signals.

534.862.4 : 621.395.625.3 **2824**
Survey of Flux-Responsive Magnetic Reproducing Heads.—O. Kornei. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 575–580.)

621.395.623.743 **2825**
Wide-Range Electrostatic Loudspeakers.—P. J. Walker. (*Wireless World*, May, June & August 1955, Vol. 61, Nos. 5, 6 & 8, pp. 208–211, 265–269 & 381–384. Correction, *ibid.*, July 1955, Vol. 61, No. 7, p. 346.) By reducing the acoustical efficiency of the e.s. loudspeaker to a level comparable with that of moving-coil loudspeakers it is possible to obtain linear response over 4–5 octaves anywhere in the audible range. Methods of coupling the diaphragm to the air are discussed and compared with moving-coil practice. The advantages of a strip diaphragm of length great compared with $\lambda/3$ at the lowest frequency to be reproduced, and width small compared with λ at the highest frequency, are enumerated. The acoustical problem is discussed with reference to equivalent networks. Efficiency in converting electrical power into sound is best achieved by the use of several units each covering a restricted bandwidth ($>$ 2 octaves) and fed through crossover networks. The acoustical relations between the loudspeaker and the room in which it is used are discussed; the characteristics of small corner-mounted diaphragms are compared with those of large diaphragms radiating on both sides.

621.395.625.2 + 621.395.616 **2826**
Capacitive Transducer has Low Impedance.—H. P. Kalmus. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 161–163.) A peak-rectifier circuit is used with the transducer, comprising a pair of metal plates and a stylus between them, arranged in series with the rectifier diode. For typical stated operating conditions the device is equivalent to an audio generator with open-circuit voltage of 250 mV and internal impedance 5 kΩ. Use of the principle in the design of a gramophone pickup and a capacitor microphone is discussed briefly.

AERIALS AND TRANSMISSION LINES

621.315.212 **2827**
Investigation of a Production Length of Cable by Terminal-Impedance Measurements.—M. Cotte. (*Câbles & Transm.*, April 1955, Vol. 9, No. 2, pp. 161–171.) Local impedance variations of coaxial cable are determined by constructing a Fourier series based on terminal-impedance measurements. Both negligible and appreciable line attenuations are considered. The results agree well with those obtained by other methods.

621.315.212 + 621.372.8] : 621.317.3 **2828**
Measurement of Weak Reflections in Coaxial-Line and Waveguide Systems.—Epprecht & Stäger. (See 3037.)

621.372 **2829**
Propagation of a Fundamental Wave between Parallel Surfaces.—E. Burshtein & L. Solov'ev. (*C. R. Acad. Sci. U.R.S.S.*, 21st March 1955, Vol. 101, No. 3, pp. 465–468. In Russian.) The fundamental wave is considered to be one which, in the limiting case of plane boundary surfaces, becomes a homogeneous plane wave. The phase velocity midway between the boundary surfaces, which may be slightly curved, is calculated and the phase distribution on the midway surface and the normals to the lines of constant phase, i.e. the wave 'rays', are hence determined.

621.372.2 **2830**
The Uniform-Structure Electromagnetic Delay Line.—P. M. Prache. (*Câbles & Transm.*, April 1955, Vol. 9, No. 2, pp. 112–143.) Complete theory of a system constituted by a copper coil wound on a cylindrical insulating former and connected to a straight return wire through uniformly distributed capacitances. Calculated values of delay, characteristic impedance and attenuation for both screened and unscreened lines are in good agreement with experimental results. Optimum dimensions for obtaining given characteristics are deduced.

621.372.2 : 517 **2831**
The Electromagnetic Delay Line, Source of Relations between Bessel Functions and Elliptic Integrals.—P. M. Prache. (*Ann. Télécommun.*, April 1955, Vol. 10, No. 4, pp. 82–86.) Expressions for the delay-line vector magnetic potential and field are derived in terms of Bessel functions and quoted from standard electromagnetic theory in terms of elliptical integrals. By comparing the two sets of expressions, infinite integrals of products of Bessel functions can be reduced to elliptic integrals which can be calculated easily from tables.

621.372.8 **2832**
On the Theory of Circularly Symmetric TM Waves in Infinite Iris-Loaded Guides.—C. C. Grosjean. (*Nuovo Cim.*, 1st March 1955, Vol. 1, No. 3, pp. 427–438. In English.) Exact theory is developed, making use of the Floquet theorem. The final equations form an infinite linear system which can be transformed in several ways to derive new formulae, but which has not yet been solved explicitly.

621.372.8 **2833**
Mathematical Transformation of a System of Equations appearing in the Theory of TM Wave Propagation in Corrugated Guides.—C. C. Grosjean. (*Nuovo Cim.*, 1st March 1955, Vol. 1, No. 3, pp. 439–446. In English.)

621.372.8 **2834**

On the (β_0, k) Diagrams for Circularly Symmetric TM Waves in Infinite Iris-Loaded Waveguides.—V. J. Vanhuyse. (*Nuovo Cim.*, 1st March 1955, Vol. 1, No. 3, pp. 447–452. In English.) For the case of infinitely thin irises, the equations derived by Grosjean (2833 above) are simplified to give results directly related to the pass bands in the frequency/propagation-constant characteristics.

621.372.8 **2835**

Calculations for Ridge Waveguides.—H. G. Unger. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 157–161.) Design formulae are derived for ridge waveguides of arbitrary cross-section. Numerical examples are discussed. Results are compared with calculations for given cross-sections made by other workers.

621.372.8 **2836**

On the Proper Frequencies of Terminated Corrugated Waveguides.—V. J. Vanhuyse. (*Physica*, April 1955, Vol. 21, No. 4, pp. 269–280. Addendum, *ibid.*, July 1955, Vol. 21, No. 7, p. 603.) Starting from Maxwell's equations, analysis is given for circularly symmetrical TM waves propagated in an iris-loaded guide terminated at each end by a half-length section. The theory is extended to cases where the diameters of the sections are not all equal. Measurements were made on waveguides with one, three and five whole sections plus the terminating half-sections; the results are in good agreement with those predicted by theory.

621.396.67 **2837**

Radiation from Aerials.—G. Barzilai. (*Wireless Engr*, Aug. 1955, Vol. 32, No. 8, pp. 223–225. Correction, *ibid.*, Sept. 1955, Vol. 32, No. 9, p. 258.) "A formal expression for the complex power radiated by a thin, centre-driven aerial is derived in terms of the vector potential on the surface of the conductor, making no assumption on the distribution of current. A similar expression is then obtained for the complex power radiated by the same aerial, on the assumption of sinusoidal-current distribution. By letting the radius of the conductor approach zero, the asymptotic forms of the two aforesaid expressions are compared."

621.396.67 **2838**

Multipoles and Asymmetrical Schelkunoff Waves.—I. Ferrari. (*R. C. Accad. naz. Lincei*, March 1955, Vol. 18, No. 3, pp. 304–308.) Extension of analysis presented previously (27 of January).

621.396.676.029.53 **2839**

How to design Sailboat Antennas.—E. Robberson. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 140–143.) The special problems relating to the design of m.f. aerials for use on vessels with an extensive superstructure are discussed.

621.396.677.029.64 **2840**

Study of Multiple-Horn Aerials.—J. Salomon & B. Brunet. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1955, No. 19, pp. 75–100.) Theoretical and experimental investigations are reported of parabolic reflectors fed by several primary radiators. The advantages and limitations of defocusing are discussed. Various coupling arrangements of the primary radiators are considered. See also 2841 below.

621.396.677.029.64 : 621.396.96 **2841**

Design and Construction of Radar Aerials for the 10-cm Band.—P. E. Vincelet. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1955, No. 19, pp. 59–74.) Design problems are considered in relation to the radiation pattern required; range, gain, number of radiating elements and reflector dimensions are considered. The characteristics of the rotating joints are discussed. Details are given of an aerial with five pyramidal horns; test methods are indicated.

621.396.677.3 **2842**

Optimum Design of Directive Antenna Arrays Subject to Random Variations.—E. N. Gilbert & S. P. Morgan. (*Bell Syst. tech. J.*, May 1955, Vol. 34, No. 3, pp. 637–663.) A statistical expression is derived for the radiation pattern of an arbitrary array with random variations of the position and excitation of the elements. When the element positions are either fixed or subject to displacements with a spherically symmetrical distribution, the pattern is given by that of the undisturbed array together with a 'background' component having the same directivity as the pattern of a single element. The design of superdirective arrays is discussed with emphasis on the need to maintain this background component constant while maximizing the gain of the array. Numerical examples are given.

621.396.677.3 : 523.16 : 53.088.22 **2843**

Correcting for Gaussian Aerial Smoothing.—R. N. Bracewell. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 54–60.) If the values established in a two-dimensional radio-astronomy survey with a Gaussian aerial beam are at intervals of $\sqrt{2}$ standard deviations, then the correction for aerial smoothing is simply calculated as the difference between the value to be corrected and the mean of the neighbouring four values.

621.396.677.31 **2844**

The Effect of the Source Distribution on Antenna Patterns.—S. Matt & J. D. Kraus. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 821–825.) An examination is made of the effect on the observed polar diagram of a receiving aerial of appreciable extension of the radiation source. The problem is discussed in relation to the Ohio State University radiotelescope aerial, which comprises 96 helical aerials in a broadside array of length about 40 λ and width about 5·6 λ when operating at a frequency of 250 Mc/s. The extension of sources is deduced approximately from observed patterns; an analytical method of determining source extension is also discussed.

AUTOMATIC COMPUTERS

681.142 **2845**

Electronic Computers for the Businessman.—J. M. Carroll. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 122–131.) A survey covering 38 commercially available digital computers. Important characteristics are tabulated.

681.142 **2846**

Storage Devices for High Speed Calculators.—A. D. Booth. (*Research, Lond.*, April 1955, Vol. 8, No. 4, pp. 130–140.) A survey covering thermal, optical, sonic-delay, electrochemical, c.r. tube, ferroelectric, capacitor, magnetic-drum, magnetostriction and magnetic-core devices.

681.142 **2847**

A Proposed Modification to the C.S.I.R.O. Mark I Computer.—B. E. Swire. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 184–186.) The suggestion is put forward that a facility be built into the machine for distinguishing between machine commands and interpretive or 'hyper' commands so that the former are performed directly while on receipt of one of the latter control is directed to the head of the interpretation routine with simultaneous storage of the link datum to enable return of control to the next programme command after performance of the hyperfunction. This would result in a considerable gain in speed. See also 640 and 641 of 1954 (Pearcey & Hill).

681.142 : 511.142 **2848**

Automatic Square Rooting.—E. H. Lenaerts. (*Electronic Engng*, July 1955, Vol. 27, No. 329, pp. 287–289.) A computation method is described, with examples, and an indication is given of the type of additional circuit required in computers of the LEO type [3473 of 1954 (Pinkerton et at.)]. The square root of a 40-digit number is obtained in 6·4 ms.

681.142 : 538.221 **2849**

Multiple-Coincidence Magnetic Storage Systems.—R. C. Minnick & R. L. Ashenhurst. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 575–579.) "In existing magnetic matrix storage systems a given location is selected by applying to two intersecting wires a current equivalent to one-half of the selecting field. This situation is generalized so that any core is selected by energizing p wires each with a current equivalent to $1/p$ of the selecting field. The advantages gained are in the correspondingly smaller fields applied to the nonselected cores, or alternatively, in the faster switching times obtainable by applying a total field greater than the coercive force to the selected core... Specifically, a storage matrix is illustrated in which the cores are toroids etched from a continuous sheet of magnetic material."

681.142 : 621.384.622 **2850**

A Computer for solving some Problems in connection with Travelling-Wave Particle Accelerators.—Crowley-Milling. (See 3061.)

681.142.002.2 **2851**

Digital Computer Plug-In Units and Associated Equipment.—J. N. Harris & F. L. McNamara. (*Elect. Engng, N.Y.*, April 1955, Vol. 74, No. 4, pp. 326–329.) Basic circuits etched on small boards are plugged into standard 32-contact receptacles, 15 of which are combined in a sub-rack assembly complete with power wiring.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.7 **2852**

The Unit Step, the Unit Pulse, and the Dirac Operator.—R. Cazenave. (*Ann. Télécommun.*, March 1955, Vol. 10, No. 3, pp. 50–53.) The unit pulse is identified as the derivative of the unit step, and the identity between the unit pulse and the Dirac function is demonstrated by considering the establishment of a direct current in a circuit with finite inductance but vanishing capacitance.

621.3.049.75 **2853**

'Stamping' Metals by Etching.—A. Coleman. (*Mater. & Meth.*, March 1955, Vol. 41, No. 3, pp. 96–97.) The process briefly described consisted of printing the pattern of the desired circuit or part on a flat metal sheet or strip with an acid-resistant ink and then etching away the unprotected metal. The printing can be performed by a photographic, lithographic or silk-screen process.

621.316.8 : 621.396.828 **2854**

Resistors for Radio-Interference Suppression in Otto-Cycle [internal-combustion] **Engines.**—Henniger. (See 3083.)

621.318.57 : 621.314.7 **2855**

Directly Coupled Transistor Circuits.—R. H. Beter, W. E. Bradley, R. B. Brown & M. Rubinoff. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 132–136.) Switching circuits using surface-barrier and alloy-junction transistors are described. In many cases the only other circuit components required are resistors. Rise and fall times of about 0·08 μs and 0·10 μs respectively are obtained. Applications in digital computers are mentioned.

621.372 **2856**

Further Analysis of Transmission-Line Directional Couplers.—R. C. Knechtli. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 867–869.) The conditions for infinite directivity in transmission line directional couplers derived by Firestone (49 of January) are discussed; more general conditions are derived valid for any degree of coupling.

621.372.412 : 549.514.51 **2857**

Frequency Aging of High-Frequency Plated Crystal Units.—A. W. Warner. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 790–792.) The aging process is discussed in terms of contamination of the quartz crystal; the influence of various production methods is examined. Data obtained with units in metal and glass enclosures are presented graphically.

621.372.412 : 549.514.51 **2858**

The Effect of Temperature and Acoustic Impedance of Vapours on the Electrical Constants of Quartz.—S. Parthasarathy & V. Narasimhan. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 302–310. In English.) Measurements were made of the equivalent resistance of a crystal vibrating in vapours of various organic liquids. At a given temperature, the equivalent resistance depends on the pressure. As the temperature increases the equivalent resistance decreases, the rate of decrease depending on the particular vapour.

621.372.413 **2859**

Tunable Temperature-Compensated Reference Cavity.—M. S. Wheeler. (*Wireless Engr*, Aug. 1955, Vol. 32, No. 8, pp. 201–205.) A design is discussed based on separation of the tuning and temperature-compensation functions. Temperature compensation at fixed frequency is discussed first and the conditions for variable frequency are then deduced. Experiments indicate that a cavity with a double-nosed construction can be made satisfying the theoretical requirements over a 5% or 10% band. Analysis is presented with reference to an equivalent circuit.

621.372.5 **2860**

Active - Ladder - Network Analysis.—H. D. Polishuk. (*Wireless Engr*, Aug. 1955, Vol. 32, No. 8, pp. 215–220.) A computationally economical method is developed in which the voltage appearing across the final 'rung' of the ladder is expressed as a function of the individual randomly distributed sources of e.m.f. by a reduction process involving successive applications of Thévenin's theorem to all the meshes. The method is illustrated by examples.

621.372.5 **2861**

Representation of the General Linear Four-Terminal Network and some of its Properties.—C. G. Aurell. (*Ericsson Tech.*, 1955, Vol. 11, No. 1, pp. 155–179.) Nonreciprocal networks are considered. Equations are formulated in terms of power and impedance. A method of representation is developed based on introduction of a circuit element called the 'antireciprocal transition' in series with a reciprocal network. Power attenuation and matching are investigated. A new criterion for classifying networks as passive or active is proposed. A grounded-emitter transistor amplifier is discussed as a particular application of the theory.

621.372.5 **2862**

The Design of Quadripoles.—M. Skalicky. (*Elektrotech. u. Maschinenb.*, 15th April 1955, Vol. 72, No. 8, pp. 173–174.) In the case of symmetrical quadripoles, by writing $\sqrt{K/L} = p$ and $\sqrt{KL} = Z$, where K and L are the impedance parameters defined earlier (3030 of 1952), general expressions are derived by a matrix treatment for the current and voltage in a ladder network, in which the characteristic-impedance term Z occurs only in the first degree.

621.372.5 **2863**

Synthesis of Passive Quadripoles.—F. Hott. (*Rev. gén. Élect.*, April 1955, Vol. 64, No. 4, pp. 203–205.) It is shown that any passive quadripole can be constituted by combining a two-terminal network with a T or Π network, the whole comprising four two-terminal physically realizable networks with complex impedance.

621.372.5 **2864**

A New Method for investigating Linear Quadripoles.—J. de Buhr. (*Fernmeldetech. Z.*, April 1955, Vol. 8, No. 4, pp. 200–204.) A treatment based on representation of impedance transformations by displacements on the surface of a sphere; known graphical methods are made accessible to a purely geometric treatment by the method of projection. Problems of networks satisfying Kirchhoff's laws can be solved with compasses and ruler.

621.372.5 **2865**

Impossible Behavior of Nonlinear Networks.—R. J. Duffin. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 603–605.) The following proposition is discussed: 'An isothermal electromechanical system whose primary resistors are quasi-linear cannot convert direct current to alternating current'. A resistor is said to be quasi-linear if the voltage drop across it is a function only of the current, and if the differential resistance is positive.

621.372.5 **2866**

Note on the Kramers-Kronig Relations.—M. K. Brachman. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 497–498.) "The explicit form of the relationship between the real and imaginary parts of a physically realizable network function is correlated with the alternate conventions available for such problems. The transformation from a linear frequency scale to a logarithmic one is simply effected by considering the Mellin transforms of the appropriate functions."

621.372.5 : 621.375.13 **2867**

Some Gyrator and Impedance Inverter Circuits.—B. P. Bogert. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 793–796.) The design of feedback amplifiers to provide impedance inversion is considered. Negative-impedance elements may be included to compensate for the residual impedances in the inverter; when this is done the circuit exhibits gyrator properties. Measurements on a high-stability amplifier with a series resistance of $-600\ \Omega$ in the input lead indicated that accurate impedance inversion was obtained for load resistances from $40\ \Omega$ to $4\ 000\ \Omega$.

621.372.5 : 621.396.822 **2868**

Nyquist's and Thevenin's Theorems generalized for Nonreciprocal Linear Networks.—R. Q. Twiss. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 599–602.) Theory of nonreciprocal networks such as those including ferrites is developed taking account of internal noise sources. The system can be treated as the combination of a source-free network together with a set of correlated noise-current or noise-voltage generators. Modifications of the treatment are indicated for dealing with cases where the actual noise sources are at different temperatures, as in the problem of determining the noise correlation between two receiver channels connected to a gyrator fed by two coupled aerials.

621.372.5.012 **2869**

Determination of the Frequency and Phase Characteristics of a Network for a Given Attenuation Curve.—H. Kaufmann. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 192–198.) A modification of the graphical method developed by Baum (3040 of 1948) is described for deriving a realizable attenuation characteristic approximating to the given one.

621.372.54 **2870**

A Derivation Method for designing Two- and Three-Element Filter Structures.—J. E. Colin. (*Câbles & Transm.*, April 1955, Vol. 9, No. 2, pp. 81–111.) A summary of fundamental principles with specific examples of two- and three-element design using loss-free elements with no mutual inductance. The H, N and associative derivations, and an extension of Zobel's m derivation are treated, also the LC derivation involving interchange of L and C. Application of Norton's transformation is illustrated.

621.372.542.21 : 621.396.822 **2871**

The Noise-Power Bandwidths of Iterated Low-Pass *RC* Filters.—W. E. Smith. (*Aust. J. appl. Sci.*, March 1955, Vol. 6, No. 1, pp. 7–12.) "The noise-power bandwidths of n-section low-pass RC filters are calculated exactly from the transfer function for $n = 1$ to 6. An asymptotic expression is derived for the bandwidth when the number of sections is large, and then the bandwidth is inversely proportional to n^2."

621.373.4 **2872**

The Periodic Solutions of a Nonlinear Differential Equation of the Second Order with Unsymmetrical Nonlinear Damping, and a Forcing Term.—A. W. Gillies. (*Quart. J. Mech. appl. Math.*, March 1955, Vol. 8, Part 1, pp. 107–128.) The differential equation considered gives a closer approximation to the behaviour of valve oscillators than the van der Pol equation, and demonstrates the frequency deviation associated with the presence of higher harmonics.

621.373.42 : 621.385.029.64 : 621.316.726 **2873**

Study of the Relative Frequency Fluctuations of Two Reflex Klystrons stabilized by Different Methods.—L. Jampierre. (*Ann. Télécommun.*, March & April 1955, Vol. 10, Nos. 3 & 4, pp. 65–78 & 87–99.) In connection with projected experiments of the Michelson type, it was desired to ascertain whether a variation of 0·08 c/s due to modulation could be detected in the frequency of 10-kMc/s oscillations modulated at 0·5 c/s. A study was made of the inherent frequency fluctuations of klystron oscillators and of methods for limiting them, with particular reference to the stabilization of supply sources. Alternative electronic methods involving use of waveguides and cavity resonators were used to stabilize the frequency of the beat between the two klystron oscillations, one of which was modulated. Filters of bandwidth 0·5 c/s were used to improve this stability. Results are compared with those of Pound (1311 of 1948) and Essen (1085 of 1953); they indicate that it should be possible with present-day techniques to detect a frequency variation of the order of 1 part in 10^{11}.

621.373.42.029.64 **2874**

Phase Stabilization of Microwave Oscillators.—M. Peter & M. W. P. Strandberg. (*Proc. Inst. Radio Engrs*, July **1955**, Vol. **43**, No. **7**, pp. **869–873**.) Description of a circuit incorporating a single stable feedback loop, that has been used to stabilize the frequency of a Type-2K50 K-band klystron by locking it to a harmonic of a quartz-controlled oscillator. Any phase modulation in the klystron is detected in a phase discriminator, the resulting signal is amplified in a differential d.c. amplifier and applied to the klystron repeller electrode.

621.373.421.1 : 621.396.822 **2875**

Phase Fluctuations in a Valve Generator.—I. S. Gonorovski. (*C. R. Acad. Sci. U.R.S.S.*, 1st April **1955**, Vol. **101**, No. **4**, pp. **657–660**. In Russian.) The effect of shot noise on an oscillator operating in the steady state is considered theoretically. The intensity and the statistical properties of the shot current are independent of the feedback circuit and can thus be represented by a separate noise-current generator in parallel with the oscillator; analysis is presented on the basis of such an equivalent circuit.

621.373.421.11 **2876**

Frequency Stable *LC* Oscillators.—W. B. Bernard: J. K. Clapp. (*Proc. Inst. Radio Engrs*, July **1955**, Vol. **43**, No. **7**, pp. **875–876**.) Critical comment on **3170** of **1954** and author's reply.

621.373.431.1 **2877**

Analysis of the Relaxation Period of a Multivibrator.—D. C. Sarkar & R. Ahmed. (*Indian J. Phys.*, Nov. **1954**, Vol. **28**, No. **11**, pp. **533–541**.) The analysis takes account of positive grid swing and appreciable shunting capacitance. Comparison of values obtained from the theory with experimental results indicates that the method is satisfactory.

621.373.431.1 : 621.314.63 **2878**

A Semiconductor Diode Multivibrator.—J. J. Suran & E. Keonjian. (*Proc. Inst. Radio Engrs*, July **1955**, Vol. **43**, No. **7**, pp. **814–820**.) A circuit is described using one double-base diode [see e.g. **2535** of **1954** (Aldrich & Lesk)] together with one ordinary diode and only three resistors and one capacitor.

621.373.432 **2879**

Significance of the Mandelstam Condition in the Oscillations of a Neon Lamp.—P. Jean. (*C. R. Acad. Sci., Paris*, 23rd May **1955**, Vol. **240**, No. **21**, pp. **2059–2061**.) Theory presented previously (**3502** of **1954**) is generalized. For relaxation oscillations to occur, three conditions must be satisfied simultaneously, including the Mandelstam condition which requires that the energy of the system shall remain constant at the discontinuity. This condition can be satisfied using a *RC* circuit, but not using a *RL* circuit.

621.373.52 **2880**

Isocline Diagrams for Transistor Circuits.—F. Oakes. (*Electronic Engng*, July **1955**, Vol. **27**, No. **329**, pp. **312–317**.) "The method described for the graphical analysis of transistor negative resistance oscillators is based on non-linear mechanics, and does not necessitate approximation of curved transistor characteristics by straight lines. Voltage and current trajectories can be obtained by a simple construction which also indicates the rate of change of the voltages and currents during the course of cyclic or transient phenomena."

621.374.32 : 621.318.57 **2881**

Nonsaturating Pulse Circuits using Two Junction Transistors.—J. G. Linvill. (*Proc. Inst. Radio Engrs*, July **1955**, Vol. **43**, No. **7**, pp. **826–834**.) Junction transistors are found to be fast enough for pulse applications if the collector voltage is prevented from reaching zero. Switching times $< 1\ \mu s$ can be achieved with available types. The required limiting action is effected by introducing diodes which terminate the switching transients by their breakdown. A two-transistor binary counter is described.

621.374.4 **2882**

A Decade Frequency Divider.—R. B. Mobsby. (*Electronic Engng*, July **1955**, Vol. **27**, No. **329**, pp. **295–298**.) A divider developed for use with a quartz-crystal clock consists basically of a chain of Eccles-Jordan binary pairs whose overall division ratio has been reduced by means of feedback. A complete circuit diagram is given.

621.375.2.024 **2883**

Method of reducing Zero Error and Drift in Breaker Type D.C. Amplifiers.—T. M. Dauphinee. (*Rev. sci. Instrum.*, April **1955**, Vol. **26**, No. **4**, pp. **401–402**.) Thermal e.m.f.'s in the input transformer are cancelled by using a double-pole double-throw input chopper and connecting a high-quality capacitor in series with the winding.

621.375.2.029.4 **2884**

Low-Frequency Decoupling of Cathode and Screen Grid of an Amplifier Valve.—R. Dessoulavy. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April **1955**, Vol. **33**, No. **4**, pp. **137–143**. In French.) A method is described for using the Smith chart to determine the falling off at the upper and lower ends of the a.f. response curve due to the decoupling capacitors.

621.375.221 **2885**

Distortion and Power in Aperiodic Amplifiers using Ideal Screen-Grid Valves.—P. Schiaffino. (*Ricerca sci.*, April **1955**, Vol. **25**, No. **4**, pp. **896–921**.) Calculations are made for Class A, AB, B and C operation, assuming a parabolic or nearly parabolic valve characteristic. A determination is made of the input waveform required to give a pure sinusoidal output. The effect of negative feedback is studied. Operation with sawtooth or square pulses is discussed.

621.375.221.2 **2886**

The Band-Pass Distributed Amplifier.—V. C. Rideout & T. P. Tung. (*J. Indian Inst. Sci.*, Section B, April **1955**, Vol. **37**, No. **2**, pp. **138–161**.) General expressions are derived for the gain of a distributed amplifier with any number of valves coupled by identical filter sections. The analysis indicates that reduction of band-edge peaks is more difficult for band-pass than for low-pass amplifiers. Choice of suitable filter networks for the band-pass case is discussed, and some experimental results are presented for a 4-valve amplifier with a pass band from **51** Mc/s to **81·8** Mc/s.

621.375.223 **2887**

Design of Wide-Band *RC* Amplifiers.—E. Schuon. (*Fernmeldetech. Z.*, April **1955**, Vol. **8**, No. **4**, pp. **233–239**.) Discussion of multistage amplifier with inductive equalization in the anode circuit. The effect of negative feedback in the cathode line is examined.

621.375.232.3 **2888**

Active-Error Feedback and its Application to a Specific Driver Circuit.—J. R. Macdonald. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 808–813.) Feedback amplifiers are discussed in which the feedback signal is nominally equal to the input; the difference, which is proportional to the distortion or error in the output, is amplified in a separate circuit and re-injected with the proper polarity to reduce the output error. Analysis is given for a cathode-follower circuit incorporating this principle; the arrangement is especially suitable for driving the grid of an output valve highly positive. Experimental results support the theory.

621.375.4 + 621.373.52 + 621.318.57] : 621.314.7 **2889**

The Transistor: Part 6—Applications.—H. G. Bassett. (*P.O. elect. Engrs' J.*, April 1955, Vol. 48, Part 1, pp. 47–52.) Amplifier, oscillator and switching circuits are discussed. Part 5 : 3109 below.

621.375.4 : 621.314.7 **2890**

Linear Properties of the Transistor.—G. Ledig. (*Fernmeldetech. Z.*, April 1955, Vol. 8, No. 4, pp. 221–228.) Formulae and charts for various transistor circuits are presented.

621.375.4 : 621.314.7 **2891**

Internal Feedback and Neutralization of Transistor Amplifiers.—A. P. Stern, C. A. Aldridge & W. F. Chow. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 838–847.)

621.375.43 : 621.314.7 **2892**

Tensor Analysis of Transistor Feedback Circuits.—G. Ledig. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 162–167.) Theory is presented for the grounded-base circuit. The coefficients of the impedance matrix for the back-coupled circuit are obtained by multiplying those for the original circuit by certain characteristic tensors derived from the relation between the currents in the original and in the back-coupled arrangements. Particular conditions examined include current feedback, positive and negative voltage feedback, and other arrangements involving two feedback paths. Applicability of the duality principle is discussed.

621.376.3 : 621.317.39 **2893**

A Linear Capacitance-Change Circuit.—V. H. Attree. (*Electronic Engng*, July 1955, Vol. 27, No. 329, pp. 308–310.) Capacitance changes produced by mechanical displacement modulate the frequency of a 465-kc/s Franklin oscillator which drives a nonode f.m. discriminator. Sensitivity is 10 V/pF, and the output is linear between −40 and +40 V. About 30 references are given to measurements of mechanical and other quantities by means of a capacitance change.

621.376.32 : 621.314.63 **2894**

Crystal Diodes in Voltage Dividers, in particular for increasing the Linearity and Slope of Static and Dynamic Characteristics.—H. Meinke & A. Rihaczek. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 273–276.) H.f. voltage dividers are discussed comprising a diode in series with a passive element, the voltage division ratio being varied by suitably controlling the diode. Applications to reactance-valve f.m. circuits are described.

621.375.4.029.3 : 621.314.7 **2895**

Transistor Audio Amplifiers. [Book Review]—R. F. Shea. Publishers: Chapman & Hall, London, 52s. (*Wireless Engr*, Aug. 1955, Vol. 32, No. 8, p. 226.) Only junction transistors are considered.

GENERAL PHYSICS

53.087/.088 **2896**

Sharpening of Observational Data in Two Dimensions.—E. J. Burr. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 30–53.) The problem considered is that of recovering true distributions from smoothed observed distributions; this involves the solution of a linear integral equation. Several methods of solving the equation are examined and a technique for the application of polynomial solutions is presented. The effect of random errors in the observational data is taken into account wherever possible.

534.015.1 **2897**

Representation of the Modes of Motion of an Undamped Linear Oscillating System with Two Degrees of Freedom.—K. Auch & W. Braunbek. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 255–267.) The general solution of the differential equations for a system comprising two coupled mass-points corresponds to the superposition of two natural oscillations, but a better idea of the phenomenon is obtained by considering the motion as a single oscillation modulated in phase and in amplitude. This approach is illustrated graphically.

535.376 **2898**

Polarization Effects on the Brightness Waves of Electroluminescence.—F. Matossi. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 434–437.) The observed cyclical variation of brightness of electroluminescent systems excited by sinusoidal fields is shown to be related to polarization effects of the type discussed e.g. by Jaffé (2193 of 1952) in connection with semiconductors.

535.377 **2899**

Theory of Thermoluminescence.—Ch. B. Lushchik. (*C. R. Acad. Sci. U.R.S.S.*, 1st April 1955, Vol. 101, No. 4, pp. 641–644. In Russian.)

535.514 : 538.61 **2900**

Polarization of Light by Aspherical Ferromagnetic Particles in a Uniform Magnetic Field: Part 1—Experimental Investigations with a γ-Fe$_2$O$_3$ Smoke. Part 2—Theory.—E. Fick. (*Z. Phys.*, 10th July 1954, Vol. 138, No. 2, pp. 183–189 & 21st March 1955, Vol. 140, No. 3, pp. 308–339.)

537.122 : 530.145 **2901**

Calculation of the Elementary Electric Charge from the Energy Quantum Model.—H. Zuhrt. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 181–191.) By extending the theory developed previously (2252 of August and back references), a value of $5{\cdot}17 \times 10^{-10}$ e.s.u. is obtained for the elementary electric charge; this differs by 7·7% from the established value for the electron, the difference being mostly due to the approximations used.

537.213 : 621.372 : 517.54 **2902**

Nets composed of Parts of Circles for the Approximate Solution of Field Problems.—Tasny-Tschiassny. (See 3033.)

537.22 **2903**

Dielectric Layer with Spherical Cavity in Homogeneous Electrostatic Field.—R. N. Kaufman. (*C. R. Acad. Sci., U.R.S.S.*, 1st April 1955, Vol. 101, No. 4, pp. 633–636. In Russian.) The special case of a cavity with centre equidistant from the two faces of the layer is considered mathematically; a method is indicated for solving the problem when the cavity is not centrally placed.

537.226 **2904**

Calculation of Internal Field in Relaxation Polarization in Polycrystalline Dipole-Type Dielectrics.—G. I. Skanavi & A. N. Gubkin. (*Zh. eksp. teor. Fiz.*, Jan. 1955, Vol. 28, No. 1, pp. 85–95.)

537.311.62 **2905**

Skin Resistance of a Transmission-Line Conductor of Polygon Cross Section.—H. A. Wheeler. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 805–808.) A theorem is presented according to which a conductor whose cross-section is a polygon that can be circumscribed on a circle has the same skin resistance as a conductor of the same material having the said circle as its cross-section. See also 331 of 1943.

537.311.62 **2906**

Calculation of the A.C. Resistance of a Solid Conductor with Rectangular Cross-Section.—L. Piglione. (*Elettrotecnica*, 25th April 1954, Vol. 41, No. 4, pp. 221–224.) The Joule-effect losses are calculated, starting from Maxwell's equations and making assumptions corresponding to those for the case of a circular cross-section. The results are compared with those obtained by investigating penetration depth.

537.5 **2907**

Statistical Description of Assemblies with Collective Interaction: Parts 1 & 2.—G. Ecker. (*Z. Phys.*, 21st March 1955, Vol. 140, No. 3, pp. 274–307.) A critical review of literature on the subject is presented. Two types of assemblies of electrons and ions are distinguished: (*a*) those with a finite number of discrete beams with definite velocity, and (*b*) those with thermally disordered motion with or without superimposed beams. Investigations of the first type of assembly lead to satisfactory results; the difficulties encountered in dealing with assemblies of the second type are due to neglecting the limitations of the models used. The model of the dispersed charge-carrier assembly presented by Twiss (1316 of 1953) is then considered and the concepts of collision and the collision zone are discussed.

537.52 : 537.226 **2908**

Phenomenological Theory of Townsend Breakdown in Dielectrics.—P. L. Auer. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 320–327.)

537.52 : 538.56.029.6 **2909**

High-Frequency Gas Discharge Plasma in Hydrogen.—D. J. Rose & S. C. Brown. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 310–316.) The microwave field strength required to maintain a hydrogen plasma in the steady state is calculated from theory based on a solution of the Boltzmann transport equation. The results are in satisfactory agreement with measurements made in a resonant cavity at different values of pressure and plasma concentration.

537.525 **2910**

Theory of High-Frequency Discharge in Gases at Low Pressures. Calculation of Electron Distribution Function.—J. Salmon. (*J. Phys. Radium*, March 1955, Vol. 16, No. 3, pp. 210–218.) The electron distribution is obtained by resolving Boltzmann's equation by a method of successive approximations, considering both elastic and inelastic collisions. The electron temperature corresponding to a Maxwellian velocity distribution is derived and the general form of the equation of evolution of electronic density is given.

537.525 **2911**

Role of Positive Ions in High-Voltage Breakdown in Vacuum.—H. C. Bourne, Jr, R. W. Cloud & J. G. Trump. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 596–599.)

537.525 : 621.396.822.029.62/.63 **2912**

Microwave and Metre-Wave Radiation from the Positive Column of a Gas Discharge.—L. W. Davies & E. Cowcher. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 108–128.) Radiation intensity measurements were made at 200 Mc/s and 3 kMc/s on a Ne discharge by inserting the positive column in a resonant cavity and comparing the cavity output with that of a known noise source. The r.f. power per unit bandwidth is expressed in terms of kT', where k is Boltzmann's constant and T' is the equivalent noise temperature and is comparable with the temperature of the electrons in the discharge. The departure of T' from the value corresponding to a Maxwell or Druyvesteyn electron-velocity distribution is investigated.

537.533 **2913**

Resonance-Type Secondary-Electron Multiplication.—K. Krebs & H. Meerbach. (*Ann. Phys., Lpz.*, 15th Jan. 1955, Vol. 15, Nos. 3/4, pp. 189–206.) Electron multiplication by means of an h.f. field applied between a pair of parallel plates with secondary-electron emission rate greater than unity is considered theoretically and a relation is derived between the h.f. amplitude, the length of field lines and the phase at impact required for 'avalanche' multiplication. Expressions are also obtained for the starting and cut-off voltages. Calculated results are in good agreement with experimental results. See also 2629 of 1954 (Hatch & Williams) and 790 of 1951 (Krebs).

537.533.8 + 535.215 **2914**

Delayed Electron Emission in Metals.—K. Seeger. (*Z. Phys.*, 21st April 1955, Vol. 141, Nos. 1/2, pp. 221–236.) Continuation of earlier work (3266 of 1953). Results of experiments on W indicate that delayed-emission centres are imperfections in the lattice of the oxide surface film. These imperfections act as traps which can be emptied by heating to about 600°C and destroyed by heating to 1 000°C.

537.56 **2915**

Kinetic Theory of Weakly Ionized Homogeneous Plasmas: Part 2.—M. Bayet, J. L. Delcroix & J. F. Denisse. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 274–280.) The second-order approximation to the electron-velocity-distribution function, relating to the energy exchanges between an applied electric field and the plasma in a Lorentz-type gas, is developed. The resulting expression contains a divergent term corresponding to a nonstationary state in which the electron gas continually heats up. The quality factor, Q, of the plasma is calculated. The derivation of certain formulae used in part 1 (1624 of June) is given in an appendix.

537.56 : 538.56 **2916**

Longitudinal Plasma Oscillations: Part 1.—A. A. Luchina. (*Zh. eksp. teor. Fiz.*, Jan. 1955, Vol. 28, No. 1, pp. 17–27.) A theoretical investigation is presented in which the effect of motion of ions is taken into consideration.

537.56 : 538 56 **2917**

Longitudinal Plasma Oscillations: Part 2.—G. Ya. Myakishev & A. A. Luchina. (*Zh. eksp. teor. Fiz.*, Jan. 1955, Vol. 28, No. 1, pp. 28–37.) The equations derived in Part 1 (2916 above) are applied to the investigation of the dispersive properties of the plasma for the case of (*a*) h.f. oscillations, (*b*) l.f. oscillations, and (*c*) high electron-drift velocities. Results show that in the propagation of longitudinal waves in discharge tubes the motion of ions is frequently of importance. Formulae are derived for the dependence of the space periodicity and the damping coefficient on the discharge parameters.

537.568 **2918**

Recombination between Electrons and Positive Ions.—M. Bayet & D. Quemada. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 334–338.) A bibliography of 59 references is critically examined. Nearly always, recombination takes place by an interaction involving at least two atoms; direct recombination of an electron and a positive ion in a plasma, involving the radiation of excess energy, is relatively rare.

538.1 : 538.569.4.029.6 **2919**

Theory of Apparatus for Observation of Nuclear Magnetic Resonance.—H. Pfeifer. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 311–324.)

538.3 **2920**

A Postulational Approach to Electromagnetism.—P. Moon & D. E. Spencer. (*J. Franklin Inst.*, April 1955, Vol. 259, No. 4, pp. 293–305.)

538.561 : 537.1 **2921**

Interaction of Moving Charges with Wave Circuits.—J. R. Pierce. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 627–638.) "When a charge moves along a nondispersive transmission line it induces forward and backward wave components in the line. For unaccelerated motion there is no radiation unless the charge moves with the speed of an unforced wave. For small accelerations, both radiation to the line and electromagnetic inertial effects caused by changes in the energy of the fields will be observed. The electromagnetic mass at velocities greater than the wave velocity is negative. Large accelerations can be handled by numerical computation. In the case of dispersive circuits, the charge radiates at frequencies for which the phase velocity of the circuit is equal to the velocity of the charge. This radiation is identified with Cherenkov radiation. Similar radiation takes place when a charge moves through a plasma."

538.561 : 537.122 **2922**

Čerenkov Radiation of Electrons moving parallel to a Dielectric Boundary.—J. G. Linhart. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 527–533.) Analysis is based on an eigenfunction expansion of the e.m. field. The process may be interpreted as an excitation of surface waves.

538.566 + 534.232 **2923**

Relation between the Intensity Distributions over Radiating Systems and their Directivity Characteristics.—G. Eckart. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 177–180.) Fourier-transform analysis is used to show that, contrary to Fischer's result (1221 of 1953), the directivity characteristic of a linear or plane radiator of finite dimensions is uniquely related to the amplitude distribution over the radiator. The theory is extended to the consideration of propagation media with local inhomogeneities acting as secondary radiators, and an investigation is made of the relation between distribution of inhomogeneities and the directivity characteristic of the scattered radiation.

538.566 : 535.31 **2924**

Study of the Electromagnetic Field in the Vicinity of a Reflecting Surface.—M. Bouix. (*C. R. Acad. Sci., Paris*, 2nd May 1955, Vol. 240, No. 18, pp. 1763–1765.) Analysis is given for the general case of a plane incident wave with elliptical polarization. If the reflecting surface is an infinite plane, the reflected wave is also plane; modifications of the reflected wave by other types of reflecting surface are mentioned.

538.566 : 537.311.31 : 539.23 **2925**

Simultaneous Partial Absorption, Reflection and Transmission of a Nonuniform Plane Wave by a Thin Metal Film.—M. Gourceaux. (*C. R. Acad. Sci., Paris*, 9th May 1955, Vol. 240, No. 19, pp. 1871–1872.) The theory developed for uniform waves (1960 of July) is extended to nonuniform waves such as those propagated in waveguides. Appropriately modified expressions for the energy components are obtained by taking account of the guided-wave phase velocity. Conditions with a set of parallel films are discussed. A film of thickness such as to absorb $\frac{1}{2}$ of the incident energy can be made totally absorbing by setting up standing waves at the back surface.

538.566 : 537.533 **2926**

The Interaction between an Obliquely Incident Plane Electromagnetic Wave and an Electron Beam: Part 1.—H. Wilhelmsson. (*Chalmers tek. Högsk. Handl.*, 1954, No. 155, 31 pp. In English.) The investigation reported is relevant to the operation of mm-wave generators and to phenomena occurring in the solar corona. Analysis is presented for (*a*) magnetic field vector, and (*b*) electric field vector of the incident wave perpendicular to the electron beam; the general solution for an arbitrarily polarized wave is obtained as the sum of the two separate solutions. When the axial phase velocity of the wave is equal to the beam velocity, the beam behaves like a metal reflector. Coupling between different modes in the scattered wave and in the wave inside the beam is taken into account; this coupling vanishes if the wave is incident normally or if the beam is in vacuum. Resonance occurs at certain values of beam velocity.

538.566 : 621.372.8 **2927**

Direct Measurement of the Ellipticity of the R.F. Cotton Effect by the Quarter-Wave Method.—R. Servant, P. Loudette & A. Charru. (*C. R. Acad. Sci., Paris*, 16th May 1955, Vol. 240, No. 20, pp. 1978–1980.) Measurements were made using a circular waveguide of diameter 7 cm with an aerial at one end connected to a 9-cm-λ klystron and a rotatable probe at the other end. Two copper pins of lengths 60 mm and 40 mm respectively are fixed 62 mm apart in an axial insulator rod, making angles of 65° and 35° respectively with the direction of the electric field. The variation with wavelength of the plane of polarization and of the degree of extinction obtainable are shown graphically. It is shown that the wave is elliptically polarized by inserting a quarter-wave unit to produce a linear polarization.

538.569.4 **2928**

Electron Spin Resonance Absorption in Metals: Part 1 — Experimental.—G. Feher & A. F. Kip. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 337–348.) Measurements were made on Li, Na, K, Be, Mg, Al, Pd and W over the temperature range 4°–296°K, using a cavity-resonator technique at frequencies of 300 Mc/s and 9 kMc/s. The dimensions of the specimens were in some cases large and in others small compared with skin depth. The results are compared with those predicted by Dyson's theory (2929 below).

538.569.4 **2929**

Electron Spin Resonance Absorption in Metals: Part 2—Theory of Electron Diffusion and the Skin Effect.—F. J. Dyson. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 349–359.) Part 1: 2928 above.

538.569.4 : 535.33 **2930**

Inversion Spectrum of Ammonia.—T. Nishikawa & K. Shimoda. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 89–92.) As a result of an investigation over the frequency range 12–20 kMc/s, 29 lines have been found and 33 lines re-measured.

538.569.4 : 621.372.029.64 **2931**

Theory of Molecular [-beam] **Oscillator and Molecular** [-beam] **Power Amplifier.**—N. G. Basov & A. M. Prokhorov. (*C. R. Acad. Sci. U.R.S.S.*, 1st March 1955, Vol. 101, No. 1, pp. 47–49. In Russian.) Theory is given of a device similar to that described by Gordon et al. (100 of January). The condition for self-excitation is stated and expressions are given for the frequency, amplitude and maximum power output of the oscillator and for the power-amplification factor and the condition for linear amplification of the amplifier.

539.181.08 : 537.311.33 **2932**

A Conductivity-Type Molecular-Beam Detector.—G. Fricke & H. Friedburg. (*Z. Phys.*, 21st April 1955, Vol. 141, Nos. 1/2, pp. 171–174.) An iodine molecular beam can be detected by observing the change in conductivity due to introduction of impurities in a Cu$_2$O-film detector. The detection threshold of this device, which is briefly described, is about 5×10^9 molecules/cm^2.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **2933**

Observations of a Variable Radio Source associated with the Planet Jupiter.—B. F. Burke & K. L. Franklin. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 213–217.) A variable source of radiation on 22·2 Mc/s was observed on nine records out of a possible 31 obtained during the first quarter of 1955. The derived position of the source corresponds to that of the planet Jupiter.

523.16 : 523.72 **2934**

Monochromatic Character of Bursts of Solar R.F. Radiation.—V. V. Vitkevich. (*C. R. Acad. Sci. U.R.S.S.*, 11th March 1955, Vol. 101, No. 2, pp. 229–231. In Russian.) Bursts of solar radiation in the 200-Mc/s region were recorded simultaneously by two receivers tuned to frequency bands about 4 Mc/s apart. Analysis of the observations indicates that the average effective bandwidth of all bursts is about 6 Mc/s and that of high-intensity bursts (i.e. with intensities more than 50% above the average) is about 12·3 Mc/s. A note on similar work was published by E. Blum (*Ann. Univ. Paris*, 1953, Vol. 23, No. 1, p. 136).

523.16 : 53.088.22 : 621.396.677.3 **2935**

Correcting for Gaussian Aerial Smoothing.—Bracewell. (See 2843.)

523.16 : 621.396.822 : 523.755 **2936**

Results of Observations of Scattering of R.F. Waves by Electron [-density] **Inhomogeneities of the Solar Corona.**—V. V. Vitkevich. (*C. R. Acad. Sci. U.R.S.S.*, 21st March 1955, Vol. 101, No. 3, pp. 429–432. In Russian.) Results similar to those reported by Machin & Smith (98 of 1953) were obtained in observations of the occultations of NGC 1952 in June 1952, 1953, and 1954. The observations were made at wavelengths between 3·5 and 6 m. In 1954, interferometer base-lengths of 700 and 500 m were used at 5·8 m λ, giving beam widths of 28·5′ and 40′ respectively. Rapid amplitude changes were noticed; those associated with changes within a few seconds are believed to be due to the relativistic motion of electron inhomogeneities, those of the order of a few minutes to corpuscular streams.

523.2 : 538.3 **2937**

On an Interplanetary Magnetic Field.—A. Beiser. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 155–159.) Arguments are presented for the existence of an interplanetary magnetic field of intensity not exceeding 5×10^{-8} G. Such a field would explain the observed cut-off in the primary cosmic-ray momentum spectrum and time delays in solar-terrestrial phenomena.

523.5 : 621.396.96 **2938**

Radio-Echo Observations of Meteors in the Southern Hemisphere.—A. A. Weiss. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 148–166.) Results are presented of observations at Adelaide using apparatus similar to that described by Aspinall et al. (3003 of 1951), operating on a frequency of 67 Mc/s, and by Robertson et al. (1424 of 1954), operating at 26·8 Mc/s, for measurements of shower radiants and upper-atmosphere winds respectively.

523.72 : 621.396.822.029.6 **2939**

Solar R.F. Radiation at 10 cm Wavelength.—B. Vauquois. (*C. R. Acad. Sci., Paris*, 9th May 1955, Vol. 240, No. 19, pp. 1862–1864.) The total emission at 10·7 cm λ depends on both total area and position of sunspots. The variation with distance of the sunspots from the centre of the disk is expressed by a 'darkening' factor whose value has been determined (*a*) directly, by observing the passage of groups of spots, and (*b*) by assigning trial values and comparing the resulting value of total emission with observations. Results by the two methods are in agreement. Consideration of absorption variations to be expected in consequence of variations of sunspot position indicates that the darkening must be partly due to the change of geometric form of the emitting areas.

523.746 **2940**

The Sunspot Cycle, 649 B.C. to A.D. 2000.—D. J. Schove. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 127–146.) Analysis of available records indicates that the mean period of the fundamental sunspot cycle is 11·1 years, the length of the cycle varying in the opposite sense to auroral activity; there is also a long-term cycle with a period of $77\frac{1}{2}$–78 years.

523.75 : 550.385 **2941**

Solar Prominences and Geomagnetic Disturbance.—W. O. Roberts & D. E. Trotter. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 282–283.) An attempt, by statistical analysis of solar data, to identify the solar *M* regions with the large prominences observed at intermediate and high solar latitudes, gave negative results.

523.78 **2942**

Observations of the Infrared Radiation during the Solar Eclipse of 30th June 1954 in Tashkent.—I. N. Yaroslavtsev. (*Bull. Acad. Sci. U.R.S.S., sér. géophys.*, March/April 1955, No. 2, pp. 185–186. In Russian.) Results presented graphically show the changes during the eclipse of the fraction of the total incident flux contained in the infrared band (curve 3).

550.385 **2943**

Time Relationship of Small Magnetic Disturbances in Arctic and Antarctic.—S. J. Ahmed & W. E. Scott. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 147–154.)

550.385 : 523.7 : 523.2 : 538.3 **2944**

Solar-Terrestrial Time Delays.—A. Beiser. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 161–164.) The observed delay of about 24 hours between the meridian passage of a sunspot or flare and the onset of an associated magnetic storm or aurora is shown to originate in the deflection of the ion streams involved by either a solar magnetic dipole of moment $\ngtr 10^{29}$ G.cm^3, or an interplanetary magnetic field of intensity $\ngtr 4 \times 10^{-8}$ G, or a combination of the two. See also 2937 above.

551.510.4/.5 **2945**

Seasonal Variations of the Intensity of Bands due to OH and O_2 Molecules in the Atmosphere in the Luminescence of the Night Sky.—P. Berthier. (*C. R. Acad. Sci., Paris*, 2nd May 1955, Vol. 240, No. 18, pp. 1796–1798.)

551.510.4/.5 **2946**

Post-Twilight and Nocturnal Variations of Intensity of OH and O_2 Bands in the Near Infrared.—P. Berthier. (*C. R. Acad. Sci., Paris*, 9th May 1955, Vol. 240, No. 19, pp. 1919–1921.)

551.510.535 **2947**

First Investigation of Ambient Positive-Ion Composition to 219 km by Rocket-Borne Spectrometer.—C. Y. Johnson & E. B. Meadows. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 193–203.) Measurements were made in the range 8–49 atomic mass units (a.m.u.). The most prominent ion peaks found at altitudes between 93 and 124 km on the ascent were at 16, 26, 30 and 32 a.m.u. From 124 to 219 km ions of 16 and 32 a.m.u. persisted.

551.510.535 **2948**

On the Analysis of Experimental Recombinance Data using a Nonuniform Recombinance Model proposed by Chapman.—Chong Chol Kim & C. Dickerman. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 229–230.) Experimental values given by Mitra & Jones (114 of January) have been used to check the validity of Chapman's formula (708 of March) for height variation of recombinance, $\alpha = \alpha_0 (1 + e^{-cz})$. The best fit is obtained for $c = 1{\cdot}2$, with the recombinance datum level at 98 km. The relation between log $[n_{em}(\chi)/n_{em}(0)]$ and log cos χ, where $n_{em}(\chi)$ is the maximum density of electrons for solar zenith angle χ, is approximately linear over most of the range of χ, for $c = 1$. Corrections to Chapman's paper are notified.

551.510.535 : 523.746.5 : 621.396.11 **2949**

The Influence of the Sunspot Cycle on the (M 3000) F_2 Transmission Factor.—E. Theissen. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 243–249. In French.) An analysis of results obtained over a period of eight years by a number of stations north and south of the equator shows that the influence of the sunspot cycle on the height of the F_2 layer exhibits a seasonal and a diurnal variation, with a maximum effect in the afternoon. Noon and midnight values of the (M 3000) F_2 factor cannot be taken as representative of day and night.

551.510.535 : 523.78 : 621.396.81 **2950**

A Note on Radio Field Strength Observations made at Ahmedabad during the Total Solar Eclipse on 30 June 1954.—Rastogi & Sheriff. (See 3077.)

551.510.535 : 621.3.087.4 **2951**

Instrumentation for the Continuous Measurement of Certain Ionospheric Echo Characteristics.—R. W. Parkinson. (*Rev. sci. Instrum.*, April 1955, Vol. 26, No. 4, pp. 319–323.) Details are given of the receiving system associated with the equipment described by Jones (3599 of 1953). A crossed-loop aerial picks up both the direct and the reflected waves from the transmitter, about 5 km away. The elliptically polarized echo is resolved into components which are appropriately combined and displayed in succession on a c.r.o. Examples are shown of continuous photographic records obtained. The resolution of split echoes is facilitated by suitably varying the c.r.o. beam intensity.

551.510.535 : 621.3.087.4 **2952**

A Panoramic Ionospheric Recorder for the Study of Travelling Disturbances in the Ionosphere.—L. H. Heisler. (*Aust. J. appl. Sci.*, March 1955, Vol. 6, No. 1, pp. 1–6.) A description is given of a recorder covering the frequency range 1–15 Mc/s in $7\frac{1}{2}$ or 15 sec. This is achieved by heterodyning an oscillator which is continuously variable from 31 to 46 Mc/s with a pulsed 30-Mc/s oscillator and amplifying the resultant pulsed signal to provide the transmitter output. The same variable oscillator is used in the superheterodyne receiver. A block diagram of the recorder is given and typical *h′f* records are shown. Both single records on 16-mm film and continuous records on 35-mm film moving at $\frac{3}{8}$ or $\frac{3}{16}$ in./min can be made, using c.r. tubes with long- and short-persistence screens respectively.

551.510.535 : 621.3.087.4 **2953**

Modern Ionosphere Sounding Equipment of the Netherlands PTT: Part 2.—P. L. M. van Berkel. (*Tijdschr. ned. Radiogenoot.*, Nov. 1954, Vol. 19, No. 6, pp. 305–323. In English.) High-power slow-sweep equipment is described. The tuning mechanism comprises a set of simultaneously and continuously variable coils and capacitors, covering the range 1·3–16 Mc/s in one band. Sweep time is 100 s. Pulse output power is about 10 kW; pulse repetition frequency is usually 50 c/s. A special camera with continuous film transport is used. See also 2989 of 1953.

551.510.535 : 621.396.11.029.55/.62 **2954**

A Note on Factors affecting the Interpretation of Observations of Transient Echoes from the Ionosphere.—Shain & Kerr. (See 3075.)

551.510.535 : 621.396.812.3 : 519.24 **2955**

Notes on Correlation Methods for Evaluating Ionospheric Winds from Radio Fading Records.—D. G. Yerg. (*J. geophys. Res.*, June 1955, Vol. 60, No. 2, pp. 173–185.) A method requiring only six values of the correlation coefficient, obtained from fading records at three receiver stations, is developed. The theory is extended to include elliptical constant-correlation contours in the horizontal plane. Data obtained during February 1954 indicate that the correlation ellipse shows a preferred orientation and that fading associated with random changes in the ionosphere is as important as that associated with drift.

551.594.221 **2956**

Results of Lightning Measurements during the Years 1947–1954 on Monte San Salvatore.—K. Berger. (*Bull. schweiz. elektrotech. Ver.*, 30th April 1955, Vol. 46, No. 9, pp. 405–424.) Electrical, magnetic and optical measurements made with the equipment described previously (2618 of September) are reported and discussed.

551.594.223 **2957**

Nature of Ball Lightning.—P. L. Kapitsa. (*C. R. Acad. Sci. U.R.S.S.*, 11th March 1955, Vol. 101, No. 2, pp. 245–248. In Russian.) Energy considerations indicate that ball lightning can be sustained neither by a chemical process nor by a nuclear process. It is suggested that the luminous ball could be produced in a weakly ionized gas by a resonance process, the energy required to increase the ionization and then to maintain it inside a sphere of diameter d being supplied by r.f. waves with $\lambda = 3{\cdot}65\,d$. The centre of the sphere would coincide with a maximum of the wave interference field. The r.f. waves could be due to an oscillatory process in the ionized atmosphere excited by a lightning discharge. The proposed mechanism also explains bead lightning, the absence of influence of wind on the position of the luminous ball, and the waveguide effect of chimneys. Explosive and quiet types of decay are associated respectively with rapid and slow changes in the r.f. field strength at the end of the phenomenon. Observations in the decimetre-λ region ($d \approx 10$ to 20 cm) during thunderstorms and experiments on the artificial production of ball lightning are suggested.

551.594.5 : 621.396.11.029.62 **2958**

Radio Observations of the Aurora.—N. C. Gerson. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 263–267.) Observations during the period 1949–1951 by means of transmissions over N. America mainly at 50 Mc/s indicate that the ionization aurora occurs with greatest frequency near the equinoxes, as does the visual aurora.

LOCATION AND AIDS TO NAVIGATION

621.396.933 **2959**

The Accuracy of the V.H.F. Omnirange System of Aircraft Navigation; a Statistical Study.—W. G. Anderson. (*Trans. Inst. Radio Engrs*, March 1955, Vol. ANE-2, No. 1, pp. 25–37.)

621.396.96 + 621.396.933 **2960**

New Navigational Aids.—(*Wireless World*, Aug. 1955, Vol. 61, No. 8, pp. 375–377.) Radio and radar equipment at the 1955 Paris air show included apparatus for remote presentation of radar signals by television, incorporating a signal-storage c.r. tube at the radar site; a device for reducing cloud clutter in airborne collision-warning radar; and a blind-landing system operating on a single frequency.

621.396.96 **2961**

Some C.F.T.H. Radar Equipment for the 10-cm Band.—P. Bouvier. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1955, No. 19, pp. 11–25.)

621.396.96 **2962**

Effect of Internal Fluctuations and Scanning on Clutter Attenuation in M.T.I. [moving-target-indication] **Radar.**—R. S. Grisetti, M. M. Santa & G. M. Kirkpatrick. (*Trans. Inst. Radio Engrs*, March 1955, Vol. ANE-2, No. 1, pp. 37–41.) Charts are presented showing (*a*) the effect of fluctuations of the scatterers and (*b*) the improvement obtainable by scanning and by using aerials with specially shaped radiation patterns.

621.396.96 **2963**

Cumulative Probability of Radar Detection.—T. J. Rooney, L. S. Rider & B. H. Rudwick. (*Tele-Tech & Electronic Ind.*, April 1955, Vol. 14, No. 4, Section 1, pp. 70–72..184.) The probability of detecting a target on two successive scans before it reaches a given range is a function of the number of times it has been scanned and of the probabilities that it is seen on each of these scans. Tables and curves are given for evaluating this function and for determining the optimum scan rate for given target velocities.

621.396.96 : 519.2 **2964**

Signal-to-Noise Improvement and the Statistics of Track Populations.—N. Wax. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 586–595.) Tracking processes such as those involved in radar tracking and in scanning nuclear emulsions are studied. The equilibrium track population, the age distribution of the population at equilibrium, and a signal-to-noise improvement factor are obtained for each of the models considered. The equilibrium population can be kept to reasonably small values and the signal-to-noise ratio improved if effective methods are used to eliminate deteriorating tracks.

621.396.96 : 621.396.6 **2965**

Microwave Circuits for Radar Transmitter-Receivers.—L. Milosevic. (*Rev. tech. Comp. franç. Thomson-Houston*, April 1955, No. 19, pp. 27–57.) A detailed and fully illustrated account of equipment of the type installed at the Orly airport in 1953.

621.396.963.3 **2966**

A Note on Trace-to-Trace Correlation in Visual Displays: Elementary Pattern Recognition.—P. McGregor. (*J. Brit. Instn Radio Engrs*, June 1955, Vol. 15, No. 6, pp. 329–331.) Subjective tests made with chemical-recorder and c.r.-tube intensity-modulated displays show that over a range of input signal/noise ratio from -10 to 0 db, correlation of successive traces offers an improvement of detectability with increasing number of scans better than that theoretically obtained by 'integration'.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 : 621.316.86 : 537.312.6 **2967**

Use of Thermistors as Vacuum Gauges.—Y. Lortie. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 317–320.) The conditions necessary to secure maximum reliability and sensitivity over a given pressure range are discussed, with special reference to the range 1–10^{-3} mm Hg.

535.215 + 537.533.8 **2968**

Effect of Electron Bombardment on Secondary and Photoelectron Emission of Cesium-Antimonide.—K. Miyake. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 164–165.) Fatigue effects and modifications of the spectral photoelectric response are shown graphically.

535.215 : 537.311.33 **2969**

Temperature Dependence of the Width of the Band Gap in Several Photoconductors.—R. H. Bube. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 431–433.) The temperature variation of the energy gap in CdS, CdSe, CdTe and ZnSe is determined from measurement of the photosensitivity/wavelength characteristic at various temperatures between 90° and 400°K. The observations for CdS and CdSe suggest the existence of double conduction or valence bands.

535.215 : 546.32 **2970**

Experimental Contribution to the Theory of the External Photoelectric Effect in Compact Alkali Metals.—R. Suhrmann. (*Z. Naturf.*, Nov. 1954, Vol. 9a, No. 11, pp. 968–973.) The form of the observed spectral sensitivity curve for very pure K surfaces is discussed. A maximum is exhibited at 400 mμ; this is attributed to the variation with wavelength of the absorption coefficient and to the small depth from which the photoelectrons are emitted.

535.215 : 546.47-31 **2971**

Influence of Oxygen, Water Vapour and Organic Compounds on Photoelectric Processes in Zinc Oxide.—E. K. Putseiko & A. N. Terenin. (*C. R. Acad. Sci. U.R.S.S.*, 1st April 1955, Vol. 101, No. 4, pp. 645–648. In Russian.) Results of measurements of the change of photo-e.m.f. with short-period and with continuous illumination are presented graphically and are discussed. No effect was observed as being due to the different methods used in preparing the ZnO specimens.

535.215 : 546.482.21 **2972**

Intermittent-Illumination Measurements on Photoconducting CdS.—E. A. Niekisch. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 279–301.) The method discussed was described previously by Fassbender & Lehmann (*ibid.*, 1949, Vol. 6, No. 6, p. 215), and makes use of the possibility of varying the electron concentration of photoconductors independently of the mobility. The value found for the mobility by this method is not the 'micromobility', but a quantity dependent on the trap distribution; if the micromobility is known, the trap distribution can hence be determined. Measurements are reported of the variation of the d.c. and a.c. components with temperature and with the intensity of the intermittent illumination. Interpretation of the results does not require the assumption of a marked temperature dependence of the recombination coefficient.

535.215 : 546.482.21 : 621.396.822 **2973**

Measurement of Shot Noise in CdS Crystals.—C. I. Shulman. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 384–386.) "The noise power spectrum associated with photoconduction current in CdS crystals with indium electrodes is found to flatten off at low frequencies at a value that corresponds closely to the noise inherent in the photon absorption process itself plus that associated with the random nature of the carrier recombination process. It is found that the noise power is not a unique function of the photoconduction current, but varies as the square of the applied voltage, and linearly with light intensity, as suggested by a simple model not unlike that of the photomultiplier."

535.37 **2974**

Paramagnetic Resonance Spectrum of some Doubly Activated Phosphors.—W. Low. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 426–431.) Investigations of SrS phosphors with various rare-earth activators are reported.

535.37 **2975**

Thermoluminescence of Alkali Halide Phosphors.—H. N. Bose. (*Proc. phys. Soc.*, 1st April 1955, Vol. 68, No. 424B, pp. 249–252.)

535.37 **2976**

Determination of the Depths of Electron Traps by Thermoluminescence.—G. Curie & D. Curie. (*J. Phys. Radium*, March 1955, Vol. 16, No. 3, pp. 199–205.)

535.37 **2977**

ZnS(Ag) Phosphor Mixtures for Neutron Scintillation Counting.—P. G. Koontz, G. R. Keepin & J. E. Ashley. (*Rev. sci. Instrum.*, April 1955, Vol. 26, No. 4, pp. 352–356.)

535.37 : 532.11 **2978**

Some Investigations on the Effects of Pressure on the Luminescence of Solids.—(*Bull. Res. Counc. Israel*, Dec. 1954, Vol. 4, No. 3, pp. 219–224.)

Part 1 (pp. 219–221).—E. A. Braun.
Part 2 (pp. 222–224).—E. A. Braun & A. Barouch.

535.37 : 537.311.33 **2979**

Decay of Phosphorescence with Activators and Traps arising from the same Impurity in Different Valency States.—K. Lehovec. (*J. opt. Soc. Amer.*, March 1955, Vol. 45, No. 3, pp. 219–222.)

535.376 **2980**

Radiation-Controlled Electroluminescence and Light Amplification in Phosphor Films.—D. A. Cusano. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 546–547.) Preliminary report of effects observed when a voltage is applied to a nongranular layer of ZnS:Mn,Cl phosphor excited by ultraviolet or X rays.

535.376 **2981**

Theoretical Basis for Light-Amplifying Phosphors.—F. E. Williams. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 547–548.) Brief discussion of electroluminescence indicating mechanisms which may be responsible for producing light amplification.

535.376 : 546.472.21 **2982**

Decay of Luminescence of Silver-Activated Zinc Sulphide Phosphors following Excitation by Single α Particles and Electrons.—D. Smidt. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 325–336.) Measurements on phosphors in powder and in single-crystal form are reported. The decay curve is hyperbolic, as for excitation by light. An empirical formula is derived relating activator concentration and decay time constant. The diffusion of holes and conduction electrons is discussed.

537.226/.227 **2983**

Dielectric Properties of Lead-Strontium Titanate.—S. Nomura & S. Sawada. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 108–111.) Experiments are reported indicating that lead-strontium titanate is ferroelectric. The Curie temperature decreases linearly with increase of the Sr^{2+} content; no other transition point was observed.

537.226/.227 **2984**

Dielectric Properties of Titanates containing Sn^{4+} Ions: Part 1.—S. Nomura. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 112–119.) Dielectric and thermal properties and lattice constants of the solid solutions of $Pb(TiSn)O_3$ and $Ba(TiSn)O_3$ were investigated, for the purpose of making clear the role of the Y ion in compounds of the perovskite type, XYO_3. The variations with composition of the Curie point are reported. An anomalous hysteresis phenomenon observed in $Pb(25\%Ti\text{–}75\%Sn)O_3$ suggests that the Ti^{4+} and Sn^{4+} ions respond differently to the external field in the ferroelectric state.

537.226/.227 : 546.431.824-31 **2985**

Phase Equilibria in the System BaO-TiO .—D. E. Rase & R. Roy. (*J. Amer. ceram. Soc.*, March 1955, Vol. 38, No. 3, pp. 102–113.) Extensive investigations using quenching, strip-furnace and thermal techniques indicate the existence of five intermediate compounds in the system $BaO\text{-}TiO_2$; these are the orthotitanate Ba_2TiO_4, the metatitanate $BaTiO_3$, the dititanate $BaTi_2O_5$, the trititanate $BaTi_3O_7$ and the tetratitanate $BaTi_4O_9$. Properties of these compounds are tabulated. Application of the results to the manufacture of titanate bodies and to the growth of single crystals of $BaTiO_3$ is discussed.

537.226.2 **2986**

Dielectric Anomaly of Ammonium Sulfate at its Transition Temperature.—K. Kamiyoshi & T. Miyamoto. (*Sci. Rep. Res. Inst. Tohoku Univ.*, Ser. A, Feb. 1955, Vol. 7, No. 1, pp. 91–98.) An anomalous variation of the dielectric constant accompanied by a phase transition in a single crystal of ammonium sulphate was observed at a.f. and r.f. A sharp peak appeared in the *a*-axial direction and kinks appeared in *b*- and *c*-axial directions; the transition temperature was −36°C on cooling and −29°C on heating. The dielectric constants at room temperature were 8·0, 7·45 and 6·7 along *a*-, *b*- and *c*-axial directions, respectively. They are independent of frequency between 10 and 10^5 kc/s. The transition temperature of a pressed polycrystalline powder specimen was about −53°C.

537.227 **2987**

New Class of Ferroelectrics.—A. N. Holden, B. T. Matthias, W. J. Merz & J. P. Remeika. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, p. 546.) Guanidine aluminium sulphate hexahydrate $(CN_3H_6)Al(SO_4)_2.6H_2O$ has been observed to be ferroelectric at temperatures from about 200°C downwards.

537.227/.228 : 537.311.33 **2988**

Space-Charge Layer near the Surface of a Ferroelectric.—W. Känzig. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 549–550.) Theoretical considerations indicate that space-charge layers and associated strong electric fields near the surface of highly polarizable semiconductors could produce observable piezoelectric or electrostrictive strain. Experimental evidence for the existence of such layers in $BaTiO_3$ is mentioned.

537.227 : 546.321.85-841 **2989**

Spontaneous Polarisation of KH_2PO_4 and KD_2PO_4 Crystals versus Temperature.—J. Pirenne. (*Physica*, March 1955, Vol. 21, No. 3, pp. 219–222.)

537.227 : 546.431.824-31 **2990**

Etch Patterns and Ferroelectric Domains in $BaTiO_3$ Single Crystals.—J. A. Hooton & W. J. Merz. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 409–413.) Technique for investigating ferroelectric domains in $BaTiO_3$ is based on the observed fact that the positive end of the electric dipole in the material etches much faster than the negative end.

537.228.1 **2991**

Piezoelectricity of Wood.—E. Fukada. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 149–154.) The direct and converse piezoelectric effects were studied in maple, spruce and ash. The magnitude of the piezoelectric constants d_{14} $(= -d_{25})$ is of the order of 10^{-9} e.s.u. The apparent piezoelectricity of wood may be explained by a particular arrangement of natural cellulose micelles. The experimental arrangement is described and results are presented in tabular and graphical form.

537.311.31 + 537.533 **2992**

Dependence of Electrical Conductivity and Electron Emission on Power Consumption of Metal during Heating by [pulsed] **High-Density Current.**—L. N. Borodovskaya & S. V. Lebedev. (*Zh. eksp. teor. Fiz.*, Jan. 1955, Vol. 28, No. 1, pp. 96–110.) In heating Ni wires by currents of densities $6 \times 10^4 - 5 \times 10^6$ A/cm² effects similar to those observed in W [3528 and 3574 of 1954 (Lebedev & Khaikin)] were found. Discontinuities were found in the resistance/energy-supplied curve; their positions remained independent of variations of the current density in Ni, W, Au, and constantan wires. The emission from Ni at current densities of about 10^5 A/cm² was $1{\cdot}6 \times 10^{-4}$ A/cm², about 50 times that at the melting point.

537.311.33 **2993**

Forbidden and Permitted Bands in Impure Semiconductors and in Disordered Alloys.—J. des Cloizeaux. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 320–324.) The semiconductor or disordered alloy is represented by a unidimensional crystal made up of cells of two distinct types, distributed at random. In such a distribution domains of impurity of any concentration may occur, consequently the permitted energy bands are much wider than in ordered distributions. Calculations are made for the general case and for some particular distributions. In the general case permitted bands exist outside the limits of bands permitted in either of the separate constituents.

537.311.33 **2994**

Propagation and Plasma Oscillation in Semiconductors with Magnetic Fields.—B. Lax & L. M. Roth. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 548–549.) Magneto-ionic theory is applied to study semiconductors whose energy surfaces in the Brillouin zone are ellipsoidal or warped spheres possessing cubic symmetry.

537.311.33 : [546.28 + 546.289 **2995**

Cyclotron Resonance of Electrons and Holes in Silicon and Germanium Crystals.—G. Dresselhaus, A. F. Kip & C. Kittel. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 368–384.) Measurements are made at temperatures near 4°K in order to obtain relaxation times long enough to permit observation of cyclotron resonance with X- or K-band equipment. An optical method is used to generate free carriers. Anisotropy effects are observed. In both Si and Ge the electron energy surfaces near the band edge are deduced to be prolate spheroids; formulae are also given for the hole energy surfaces.

537.311.33 : 546.28 **2996**

Optical Determination of Base Width in Grown *n-p-n* Silicon Crystals.—A. Fowler & P. Levesque. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 641–642.) A development of the etching technique described by Billig & Dowd (3332 of 1953).

537.311.33 : 546.289 **2997**

Thermal Acceptors in Germanium.—R. J. Hodgkinson. (*Phil. Mag.*, April 1955, Vol. 46, No. 375, pp. 410–421.) Results reported earlier (*G.E.C. J.*, Jan. 1954, Vol. 21, No. 1, pp. 63–70) are examined on the assumption that the thermal acceptors are Cu atoms. A thermodynamic treatment of the solid solubility of Cu in Ge is given in terms of the Principle of Lowest Free Energy. An equation derived, relating the concentration of Cu on the liquidus and solidus to the temperature, is equivalent to one previously derived by Thurmond & Struthers (2420 of 1954) and is shown to be in good agreement with experimental results.

537.311.33 : 546.289 **2998**

Properties of Germanium Doped with Nickel.—W. W. Tyler, R. Newman & H. H. Woodbury. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 461–465.) "The temperature dependence of electrical resistivity in *p*- and *n*-type nickel-doped germanium crystals indicates that nickel introduces two acceptor levels in germanium at 0·22 ± 0·01 eV from the valence band and 0·30 ± 0·02 eV from the conduction band. Ionization energies deduced from infrared photoconductivity studies at 77°K are in agreement with the values obtained from resistivity measurements. *N*-type samples show higher photosensitivity than *p*-type samples and demonstrate quenching effects. The distribution coefficient for nickel in germanium is about $2{\cdot}3 \times 10^{-6}$."

537.311.33 : 546.289 **2999**

Measurement and Interpretation of Conductance of *P*-Type Inversion Layers on Germanium.—G. A. deMars, H. Statz & L. Davis, Jr. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 539–540.) Measurements similar to those made previously on *n*-type inversion layers [e.g. 166 of 1954 (Brown)] are reported and discussed.

537.311.33 : 546.289 **3000**

Structure of Surface States at the Germanium/Germanium-Oxide Interface.—H. Statz, L. Davis, Jr, & G. A. deMars. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 540–542.) The surface states are discussed in relation to the observed variation of conductance on application of a switching voltage.

537.311.33 : 546.289 **3001**

Influence of Various Etchants on Germanium: Part 1—Chemical Action of some Agents on Ge.—O. Rösner. (*Z. Metallkde*, March 1955, Vol. 46, No. 3, pp. 225–229.) The action of some liquid and gaseous agents was investigated by microscope and by gravimetric methods. Ge is strongly attacked by water, especially on prolonged boiling. Oxidation occurs in air; the reaction $GeO_2 + Ge = 2GeO$ is observed at 900°C. Carbonic acid attacks Ge at temperatures above 700°C. The possibility of recovering Ge from various etching solutions is discussed and some numerical results are presented.

537.311.33 : 546.289 **3002**

Influence of Various Etchants on Germanium: Part 2—Physical Considerations.—G. Zielasek. (*Z. Metallkde*, March 1955, Vol. 46, No. 3, pp. 229–233.) Measurements of surface potential of etched polycrystalline specimens indicated sudden resistivity changes of some hundreds of ohm-centimetres at grain boundaries; both these and the ordinary resistivity distributions within single crystals are demonstrated by maps of the equipotential lines. Use of a template to simplify determinations of carrier lifetime is described. A mean value of about 4 μs was found for the hole lifetime in polycrystalline *n*-type material, and values up to 700 μs for single crystals.

537.311.33 : 546.289 **3003**

Mass-Spectrometer Investigations of Germanium.—G. Köhl. (*Z. Naturf.*, Nov. 1954, Vol. 9a, No. 11, pp. 913–918.) A method is described capable of indicating the presence in Ge of elements with relative concentrations as low as 10^{-5} to 10^{-6}.

537.311.33 : 546.289 : 537.534.9 **3004**

Effects produced by the Ionic Bombardment of Germanium.—W. D. Cussins. (*Proc. phys. Soc.*, 1st April 1955, Vol. 68, No. 424B, pp. 213–222.) Single-crystal and polycrystalline specimens were bombarded with positive ions of energy ranging from 5 to 90 keV; elements of atomic number ranging from 1 to 51 were used. The effect on rectification characteristics and thermoelectric properties was investigated; in all cases maximum effect was produced by bombardment equivalent to about 6 μC/cm². No effect was observed for ion energies less than about 20 keV. The results are consistent with the assumption that bombardment produces a *p*-type layer, whether the original specimen is *p*-type or *n*-type. Reference is made to a similar investigation on Si [see e.g. 1337 of 1952 (Ohl)].

537.311.33 : 546.289 : 538.63 **3005**

On the Hall Effect of *P*-type Germanium in the Near Intrinsic Range.—Y. Kanai & K. Furusyō. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 165–166.) Experiments were made using high values of magnetic field *H* to facilitate examination of terms involving powers of *H* higher than the first. The variation of Hall constant with values of *H* up to 7 kG is shown graphically for various temperatures up to 85°C. The variation is in the opposite sense to that calculated by Madelung (3579 of 1954).

537.311.33 : 546.48-31 **3006**

The Electrical Conductivity of Cadmium Oxide at Low Temperatures.—J. A. Bastin & R. W. Wright. (*Proc. phys. Soc.*, 1st April 1955, Vol. 68, No. 424A, pp. 312–315.) Measurements of the conductivity of sintered CdO over the temperature range 1°–250°K together with measurements reported by Wright (2200 of 1951) over the range 100°–700°K are compared with the theoretical expression for the conductivity of an ionic crystal derived by Howarth & Sondheimer (381 of 1954). The resistance at zero temperature is discussed in relation to impurity scattering and crystalline boundary resistances.

537.311.33 : 546.482.31 **3007**

Electrical Conductivity of Cadmium Selenide.—K. Hauffe & H. G. Flint. (*Ann. Phys., Lpz.*, 15th Jan. 1955, Vol. 15, Nos. 3/4, pp. 141–147.) The dependence of the conductivity χ on Cd- and Se-vapour partial pressures p_{Cd} and p_{Se} was investigated experimentally in the temperature range 300–500°C. For $p_{Cd} > 10^{-1}$ Torr, $\chi \propto p_{Cd}^{1/4\cdot5}$, below 10^{-1} Torr χ is practically independent of p_{Cd}. For $p_{Se} > 10^{-2}$ Torr $\chi \propto p_{Se}^{-1/2}$, below 10^{-2} Torr χ is independent of p_{Se}. Additions of Tl_2Se up to 0·1% mol reduce the conductivity. The results are discussed.

537.311.33 : 546.561-31 **3008**

Some Semiconductor Properties of Cu_2O.—C. Fritzsche. (*Ann. Phys., Lpz.*, 15th Jan. 1955, Vol. 15, Nos. 3/4, pp. 178–181.) Experimental results indicate that the variation of conductivity of Cu_2O caused by heat treatment is more closely related to the CuO-Cu_2O equilibrium conditions than to the impurity concentration curves for Cu_2O. See also 2432 of 1954.

537.311.33 : 546.681.18 **3009**

Semiconductor Properties of Gallium Phosphide.—O. G. Folberth & F. Oswald. (*Z. Naturf.*, Dec. 1954, Vol. 9a, No. 12, pp. 1050–1051.) Optical measurements indicate that the absorption edge lies in the visible region. The width of the energy gap is 2·4 eV at absolute zero and the variation with temperature is $-5\cdot5 \times 10^{-4}$ eV/°K over the range 100°–500°K.

537.311.33 : 546.682.19 **3010**

Electrical Properties of InAs: Part 2.—O. G. Folberth, O. Madelung & H. Weiss. (*Z. Naturf.*, Nov. 1954, Vol. 9a, No. 11, pp. 954–958.) Continuation of work abstracted previously [3268 of 1954 (Folberth et al.)]. The width of the energy gap is $0\cdot47 \pm 0\cdot02$ eV at absolute zero, with a temperature variation of $-4\cdot5 \times 10^{-4}$ eV/°K. The electron mobility passes through a maximum value of about 30 000 cm/s per V/cm at room temperature, the corresponding value for the holes being 200 cm/s per V/cm.

537.311.33 : 546.682.86 **3011**

Cyclotron and Spin Resonance in Indium Antimonide.—G. Dresselhaus, A. F. Kip, C. Kittel & G. Wagoner. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 556–557.) Observations at a frequency of 24 kMc/s are briefly reported.

537.311.33 : 546.811-17 : 538.22 **3012**

Magnetic Properties of the Exciton.—A. G. Samoilovich & M. V. Kononova. (*C. R. Acad. Sci. U.R.S.S.*, 1st March 1955, Vol. 101, No. 1, pp. 55–57. In Russian.) A brief theoretical note with particular reference to the magnetic properties of semiconductors. A numerical check of the formula for magnetic susceptibility for the case of grey tin shows fair agreement with experimental results reported by Busch & Mooser (1476 1954) over a large temperature range.

537.311.33 : 621.314.63 **3013**

The Effect of Discontinuous Space Charge on Rectifier Characteristics.—G. G. Wiles. (*Phil. Mag.*, April 1955, Vol. 46, No. 375, pp. 363–375.) An expression is derived for the local current density in the blocking direction near an impurity centre situated in the semiconductor at an optimum distance from the metal. The effects of these local currents on the average current through the interface is evaluated for the case of a uniform distribution of impurity centres. For semiconductors with a dielectric constant of 10 a continuous distribution of space charge can be assumed for impurity-centre concentrations up to 10^{16}/cm^3, but the error becomes appreciable at 10^{18}/cm^3. The case of a random distribution is treated by a more approximate method; the results are similar to those for a uniform distribution.

537.32 **3014**

On the Thermoelectric Power of Metals.—D. ter Haar & A. Neaves. (*Proc. roy. Soc. A*, 22nd March 1955, Vol. 228, No. 1175, pp. 568–574.) A theoretical paper based on a method employed by Makinson (2343 of 1940). An expression is derived for the contribution of the lattice current to the thermoelectric power of metals at temperatures where electron-phonon scattering predominates. In this range the thermoelectric effect will be of opposite sign to that which follows from simple electron theory of metals. The effect discussed cannot explain the known behaviour of alkali metals completely.

538.22 **3015**

Magnetic Anisotropy and Van Vleck's Relation for Antiferromagnetics.—K. F. Niessen. (*Philips Res. Rep.*, April 1955, Vol. 10, No. 2, pp. 131–140.) Account is taken of the two kinds of magnetic spin in deriving formulae for the influence of magnetic anisotropy on the susceptibility of antiferromagnetics and for the relation between the powder susceptibilities at 0°K and at the Curie temperature.

538.22 : 548.0 **3016**

Theory of Ionic Ordering, Crystal Distortion, and Magnetic Exchange Due to Covalent Forces in Spinels.—J. B. Goodenough & A. L. Loeb. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 391–408.) "A new magnetic exchange mechanism, 'semicovalent exchange', which is consistent with the covalent model, is used to explain the magnetic properties of spinels."

538.221 **3017**

The ΔE-Effect and Young's Modulus in Nickel-Cobalt Alloys.—M. Yamamoto & S. Taniguchi. (*Sci. Rep. Res. Inst. Tohoku Univ.*, Ser. A, Feb. 1955, Vol. 7, No. 1, pp. 35–49.) Measurements are reported covering the whole range of composition of Ni-Co alloys; a magnetostrictive-vibration method was used. See also 1077 of April (Yamamoto).

538.221 **3018**

The Absence of Bloch Walls in Certain Ferromagnetic Materials.—P. M. Prache. (*Câbles & Transm.*, April 1955, Vol. 9, No. 2, pp. 172–173.) Arising out of the work of Néel (3151 of 1947) it is shown that Bloch walls cannot exist in polycrystalline specimens of ferromagnetic materials when the crystal diameter is less than a critical value. For ordinary soft iron this value is about $20\,\mu$.

538.221 **3019**

Causes of Permeability Variations of Iron-Silicon Single Crystals on cooling in a Magnetic Field.—H. Fahlenbrach. (*Naturwissenschaften*, April 1955, Vol. 42, No. 7, pp. 174–175.) The effect on a 3% Si-Fe alloy of cooling in a magnetic field was investigated by observation of domain structure and by measurement of initial magnetization curves, using corner-shaped specimens and a circular magnetic field. Different results are obtained depending on the orientation of the specimen relative to the field. A detailed report is to appear in Technische Mitteilungen Krupp.

538.221 **3020**

Characteristic Bitter Patterns on Internally Strained Silicon-Iron Crystals.—W. Stephan. (*Ann. Phys., Lpz.*, 15th March 1955, Vol. 15, Nos. 5/6, pp. 337–344.)

538.221 : 538.569.4 **3021**

Interaction between Spin Waves and Conduction Electrons in Ferromagnetic Metals.—E. Abrahams. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 387–390.) Calculations of relaxation time indicate that the effect due to interaction between ferromagnetic spins and conduction-electron currents is much more important than that due to interaction between ferromagnetic spins and conduction-electron spins.

538.221 : 538.569.4 **3022**

Ferromagnetic Resonance Absorption in $BaFe_{12}O_{19}$, a Highly Anisotropic Crystal.—J. Smit & H. G. Beljers. (*Philips Res. Rep.*, April 1955, Vol. 10, No. 2, pp. 113–130.) Measurements at 24 kMc/s show that resonance conditions are strongly influenced by the anisotropy of the hexagonal crystal and also, with nonsaturating fields, by the domain structure. Absorption peaks predicted by theory were observed. Values are found for the anisotropy field and for the gyroscopic splitting factor, *g*, this latter showing the spin-only value. The anisotropy is probably caused by dipole-dipole interaction.

538.221 : 538.639 : 546.3-1-72-74-73 **3023**

Goldhammer Effect in Alloys of the Ternary System Iron-Nickel-Cobalt.—N. V. Grum-Grzhimailo. (*Bull. Acad. Sci. U.R.S.S., tech. Sci.*, Dec. 1954, No. 12, pp. 137–139. In Russian.) Results are tabulated and presented graphically of an investigation of the dependence of the relative change of resistance under the influence of a longitudinal magnetic field (Goldhammer effect) on the composition of the alloy. A characteristic of the diagram is the discontinuity near the composition $FeNi_3CoNi$. No special effect is exhibited at phase boundaries.

538.221 : 621.318.134 **3024**

Magnetic Rotation Phenomena in a Polycrystalline Ferrite: Part 2.—D. Park. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 438–441.) Calculations made previously (2036 of July) are extended to the determination of the complete permeability tensor for a sample with a net uniform magnetization.

538.221 : 621.318.134 3025

Direct Observation of Domain Rotation in Ferrites.—F. Brown & C. L. Gravel. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 442–448.) An experimental investigation was made using a Ni-ferrite sphere of diameter 5 mm with mutually perpendicular primary and secondary loops surrounding it. The system was adjusted for minimum r.f. signal with the sphere demagnetized; application of a magnetic field as low as 5 oersted perpendicular to both loops produced a measurable induction signal attributable to domain rotation as distinct from domain-wall motion. Measurements were made over the frequency range 20–800 Mc/s. Dispersion effects are discussed.

539.23 3026

Optical Constants of Thin-Film Materials.—G. D. Scott. (*J. opt. Soc. Amer.*, March 1955, Vol. 45, No. 3, pp. 176–179.) A short survey covering both metal and dielectric films.

546.719 3027

Rhenium Metal.—C. T. Sims. (*Mater. & Meth.*, March 1955, Vol. 41, No. 3, pp. 109–111.) The physical and mechanical properties of Re are briefly discussed and compared with those of W and Mo. Possible applications include valve heater filaments and electrical contacts. The metal is more resistant than W to water vapour.

549.514.51 3028

Variation of the Elastic Constants of Quartz with Pressure up to 1 000 Atm.—C. Susse. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 348–349.) Resonance-frequency/pressure characteristics of quartz crystals cut at various angles provide an indication of the variation of the elastic constants with pressure. See also 442 of 1953 (Pérez & Johannin).

621.315.613.1 3029

Conductivity induced in Mica by X-Rays.—J. F. Fowler & F. T. Farmer. (*Nature, Lond.*, 9th April 1955, Vol. 175, No. 4458, p. 648.) Results of experiments indicate that the conductivity induced in mica by X rays is of the same order as that in perspex and amber.

537.226 + 621.315.6 3030

Dielectric Materials and Applications. [Book Review]—A. R. von Hippel (Ed.). Publishers: John Wiley & Sons, New York, and Chapman & Hall, London, 1955, 438 pp., 140s. (*Electronic Engng*, July 1955, Vol. 27, No. 329, p. 324.) Includes the M.I.T. Tables of Dielectric Materials and gives the electrical constants of some 600 materials over a wide range of frequencies and temperatures.

MATHEMATICS

517 3031

On Spheroidal Functions.—T. Aoi. (*J. phys. Soc. Japan*, Feb. 1955, Vol. 10, No. 2, pp. 130–141.) Functions are discussed which satisfy differential equations of the form

$$\frac{d}{dz}\left\{(1-z^2)\frac{dZ}{dz}\right\} + (\lambda + \kappa^2 z^2)\,Z = 0.$$

The analysis is relevant to the problem of scattering of e.m. waves by spheroidal obstacles.

517 : 621.372.2 3032

The Electromagnetic Delay Line, Source of Relations between Bessel Functions and Elliptic Integrals.—Prache. (See 2831.)

517.54 : 537.213 : 621.372 3033

Nets composed of Parts of Circles for the Approximate Solution of Field Problems.—L. Tasny-Tschiassny. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 8–29.) The differential equation describing the current flow in a plane sheet can be solved approximately by a procedure in which the two-dimensional continuum is replaced by a net of straight-line-bounded meshes, leading to an electrical network of conductances. Using the methods of conformal transformation, meshes bounded by curvilinear rectangles can be similarly dealt with. A method is also developed for reducing the number of meshes without impairing the accuracy of the solutions. Two examples using nets of four meshes illustrate the method; the maximum errors are of the order of a few per cent.

MEASUREMENTS AND TEST GEAR

529.786 + 621.3.018.4(083.74)] : 621.373.421.13 3034

[British] **Post Office Quartz Oscillators for Use in Time and Frequency Standardisation Abroad.**—J. S. McClements. (*P.O. elect. Engrs' J.*, April 1955, Vol. 48, Part 1, pp. 26–28.) The uses and principles of calibration of oscillator clocks at an observatory are discussed, and a description is given of installations carried out in the United States and Canada.

621.317.3 3035

Power Frequency Measurements.—H. D. Hawkes. (*Elect. J.*, 29th April 1955, Vol. 154, No. 17, pp. 1366–1367.) The equipment of a standards room is briefly described. A range of measurement of 40–2 500 c/s, 5–750 V and 10 mA–5 A is covered with an accuracy within 0·1% by a single electronic generator, an a.c.-d.c. comparator, two transfer instruments and a frequency standard.

621.317.3 : 621.315.2 3036

Location of Faults in Cables.—F. Nüsseler. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April 1955, Vol. 33, No. 4, pp. 166–168. In German and French.) The influence of the shunt conductance of the undamaged conductor on the accuracy of fault location by the Wheatstone-bridge method is discussed.

621.317.3 : [621.315.212 + 621.372.8 3037

Measurement of Weak Reflections in Coaxial-Line and Waveguide Systems.—G. W. Epprecht & C. Stäger. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April 1955, Vol. 33, No. 4, pp. 143–155. In German.) Various measurement methods are described using commercially available instruments giving readings accurate to within ±0·3%. Arrangements having greater accuracy are discussed. Measurements are reported on 15 different types of coaxial connectors, some of them specially designed to have low reflection coefficient and dispersion. Reflection coefficients down to 2% or 3% are attainable at frequencies up to 4 kMc/s.

621.317.3 : 621.318.4 3038

Theory of Helmholtz Coils.—P. Goudal. (*Rev. gén. Élect.*, April 1955, Vol. 64, No. 4, pp. 199–202.) The field of the coils is calculated from the magnetic potential on the axis, which in turn is calculated using a series development of Legendre polynomials.

621.317.3 : 621.396.62 3039

Measurements on Radio Receivers.—P. Dehmelt, E. Frommer & W. Kronjäger. (*Arch. tech. Messen*, March–May 1955, Nos. 230–232, pp. 51–54, 77–80 & 97–100.) The measurements described apply to both a.m. and f.m. receivers and cover sensitivity, selectivity, frequency stability, tuning accuracy, quality of reproduction, and unwanted radiation. C.C.I.R. definitions and methods are given.

621.317.3.029.64 **3040**

Measurements on Dielectric and Ferromagnetic Materials at Frequencies around 10 kMc/s.—G. Klätte. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 256–261.) Complex permittivities and permeabilities are measured by means of a standing-wave indicator, the specimen being inserted into a rectangular waveguide. Results are presented in tables and graphs.

621.317.328 : 621.372.413 **3041**

Resonant-Cavity Field Measurements.—S. W. Kitchen & A. D. Schelberg. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 618–621.) Use of a perturbation technique [see e.g. 2265 of 1952 (Maier & Slater)] for measurements of both electric and magnetic field components is described.

621.317.332.029.55/.62 **3042**

Measurement of Resistance with the Measuring Junction.—A. Egger. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 277–281.) For measurements in the frequency range 20–300 Mc/s a device is used comprising three mutually perpendicular coaxial-line sections, one terminated by the unknown resistance, another terminated by a standard resistance, and the third leading to the supply. A rotatable coupling loop is arranged to respond to the magnetic field due to the currents in the resistance-terminated arms. Operation can be made largely automatic; an impedance plotter can be developed without much additional equipment.

621.317.34 **3043**

Survey of Methods in Use for Measurements on High-Frequency Cables.—E. Widl. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 262–265.) Tables give methods of measuring characteristic impedance, internal nonuniformities, propagation coefficient, and cross-talk and transfer impedance; basic circuit diagrams are included.

621.317.361 : 621.374.4 **3044**

Frequency Multipliers and Converters for Measurement and Control.—J. M. Shaull. (*Tele-Tech & Electronic Ind.*, April 1955, Vol. 14, No. 4, Section 1, pp. 86–89..160.) Circuits, mainly using double-triode valves, are described which enable frequencies in the range 100 kc/s–100 Mc/s to be compared with an error not greater than one part in 10^{10}. The design ensures freedom from mains hum and eliminates sidebands and phase instability. A tuned cavity unit extends the working range to 1 kMc/s. See also 2069 of July.

621.317.42 : 538.569.4 **3045**

Magnetic-Field Meter based on Magnetic Resonance of Protons.—N. I. Leont'ev. (*Zh. eksp. teor. Fiz.*, Jan. 1955, Vol. 28, No. 1, pp. 77–84.) The instrument described makes use of the resonance absorption due to nuclear magnetic moments of protons of accurately known gyromagnetic ratio. The probe, which contains a 10% solution of ferric chloride, is described in detail and the circuit is explained with reference to diagrams. Field strengths between 1 000 and 7 000 oersted are covered in three oscillator-frequency ranges between 4·25 and 30 Mc/s. A measurement precision to within 0·006% has been obtained.

621.317.7 **3046**

Notes on the Protection of Electrical Measurement Apparatus against Explosions.—A. Ohlhans. (*Arch. tech. Messen*, April 1955, No. 231, pp. 25–27.)

621.317.7 : 621.314.63 **3047**

Some Applications of the Nonlinear Characteristic of Germanium Crystal Diodes.—Koch. (See 3108.)

621.317.7.029.64 **3048**

Ring-Shaped Waveguide Measurement Line with Automatic Visual Indication.—H. Ritzl & H. Groll. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 281–286.) Technique developed for measurements at decimetre wavelengths [see e.g. 3198 of 1949 (Meinke)] is adapted to the centimetre band. Commercially produced apparatus is described.

621.317.725.024 **3049**

An Electronic D.C. Millivoltmeter.—A. L. Biermasz & A. J. Michels. (*Philips tech. Rev.*, Oct. 1954, Vol. 16, No. 4, pp. 117–122.) An instrument for measuring voltages between 1 mV and 300 V includes a vibrator for converting the direct voltage to be measured into a square-wave voltage which is amplified by an a.c. amplifier. The vibrator is driven by an electrodynamic system in which the coil is associated with a valve oscillator. Both the oscillator and the amplifier are operated from batteries, so that voltages can be measured between points at high potential.

621.317.729 : 537.291 **3050**

The Determination of Electron Trajectories in the Presence of Space Charge.—D. L. Hollway. (*Aust. J. Phys.*, March 1955, Vol. 8, No. 1, pp. 74–89.) Methods are developed for simulating clouds of distributed charge by discrete current sources in an electrolyte tank. The field patterns of charge regions of simple geometrical shapes are compared with those of sources and rules are deduced giving the dimensions and arrangement of a source array in any particular case. The method is applied to a plane diode, an axially symmetric electron beam and a general asymmetric beam, and the experimental results are compared with analytical solutions.

621.317.733 : 621.314.7 **3051**

A Bridge for measuring Audio-Frequency Transistor Parameters.—B. F. C. Cooper. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 796–805.) The bridge is designed to measure the usual impedance parameters for point-contact transistors; for junction transistors the parameters measured represent a compromise between the impedance parameters and the *h* parameters derived when input current and output voltage are treated as the independent variables. The frequency of operation is 1 kc/s. The grounded-base connection is used for point-contact transistors and the grounded-base or grounded-emitter connection for the junction types.

621.317.75 **3052**

Inexpensive Wave Analyser.—M. G. Scroggie. (*Wireless World*, Aug. 1955, Vol. 61, No. 8, pp. 360–365.) Analysis of the distortion products of an equipment is performed by means of a synchrodyne circuit enabling a simple low-pass filter to be used in place of the usual band-pass i.f. system.

621.317.755.084 : 621.385.012.3 **3053**

The Characteristic-Curve Tracer, a Universal Valve Tester.—C. Berthold & H. Berthold. (*NachrTech.*, March & April 1955, Vol. 5, Nos. 3 & 4, pp. 116–120 & 177–179.) A c.r.o. valve tester of East German manufacture is described, intended for testing low-power valves such as receiver types. Provision is also made for testing crystal diodes, rectifiers, gas triodes and glow lamps. The c.r.o. screen area used is 5×6 cm. Some characteristic-curve traces obtained are shown and briefly discussed.

621.397.6.001.4 : 535.623 **3054**

Color-Video Envelope-Delay Measurement.—Kennedy & French. (See 3097.)

621.397.62.001.4 **3055**

Methods for Measurement of Selectivity and Delay Characteristics of Television Receivers.—Griese. (See 3102.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.717.1 : 621.317.39 : 534.232-8 **3056**

Thickness Measurement by Ultrasonic Resonance.—E. G. Cook & H. E. VanValkenburg. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 564–569.) A mathematical analysis is presented which is applicable generally for any combinations of test specimen, coupling material and driving crystal.

621.317.39 : 621.376.3 **3057**

A Linear Capacitance-Change Circuit.—Attree. (See 2893.)

621.365.54 **3058**

Power Considerations in Induction Heating.—D. W. Brown. (*Electronic Engng*, July 1955, Vol. 27, No. 329, pp. 300–303.)

621.384.6 **3059**

Strong Focusing in [particle] **Accelerators.**—W. Dällenbach. (*Z. Naturf.*, Dec. 1954, Vol. 9a, No. 12, pp. 1005–1012.) Stability, periodicity and maximum elongation of betatron oscillations with strong focusing are discussed. Unstable oscillations are considered; these may become significant as semi-stable oscillations in linear and spiral accelerators. A method of treating path deviations in synchrotrons is described. An expression more general than that of Courant et al. (1454 of 1953) is derived for the path expansion determining the synchrotron oscillations.

621.384.612 **3060**

Inelastic Diffusion of Accelerated Particles in a Synchrotron.—J. Seiden & F. Lurçat. (*C. R. Acad. Sci., Paris*, 23rd May 1955, Vol. 240, No. 21, pp. 2067–2069.) Inelastic collisions give rise to (*a*) changes in particle trajectories and (*b*) loss of energy by the particles. The mechanism of (*b*), which results in synchrotron-type oscillations, is analysed. The theory is illustrated by investigating conditions for the Brookhaven cosmotron [821 of 1954 (Blewett)]; losses of protons due to inelastic diffusion are shown to be small.

621.384.622 : 681.142 **3061**

A Computer for solving some Problems in connection with Travelling-Wave Particle Accelerators.—M. C. Crowley-Milling. (*Metrop. Vick. Gaz.*, April 1955, Vol. 26, No. 429, pp. 127–131.) A mechanical system is described comprising a motor generator which, in conjunction with an amplifier and feedback system, is arranged to have an angular velocity proportional to the translational velocity of the particles.

621.385.833 **3062**

Reflection Electron Microscopy: Grazing Illumination, High-Angle Observation.—C. Fert, B. Marty & R. Saporte. (*C. R. Acad. Sci., Paris*, 16th May 1955, Vol. 240, No. 20, pp. 1975–1978.) An arrangement for observation at an angle of about 25° is discussed.

621.387.424 **3063**

Some Characteristics of Chlorine-Quenched Geiger-Mueller Counters.—A. L. Ward & A. D. Krumbein. (*Rev. sci. Instrum.*, April 1955, Vol. 26, No. 4, pp. 341–351.) Report of a comprehensive study.

621.387.424 **3064**

Mechanism of the Termination of the Geiger Plateau Region.—H. L. Wiser & A. D. Krumbein. (*Phys. Rev.*, 15th April 1955, Vol. 98, No. 2, pp. 303–310.)

621.387.424 **3065**

Measurement of Recovery Time of Geiger-Müller Counters at the Geiger Threshold.—D. Blanc. (*Nuovo Cim.*, 1st March 1955, Vol. 1, No. 3, pp. 504–506. In French.)

621.389 : 539.155.082.7 **3066**

Electrical Mass-Filter.—W. Paul & M. Raether. (*Z. Phys.*, 21st March 1955, Vol. 140, No. 3, pp. 262–273.) The motion of ions in this spectrometer is in the direction of the axis in a h.f. electric field applied between two pairs of parallel rods symmetrically placed about the axis. A d.c. potential is also applied to the rods. Alternating voltages with amplitudes of the order of 1 000 V are used; a frequency range between 1·5 and 12 Mc/s covers ion masses between 250 and 4 at optimum resolution.

621.389 : 539.155.082.7 **3067**

Transit-Time Mass Spectrometers.—R. Hofmann & W. Walcher. (*Z. Phys.*, 21st April 1955, Vol. 141, Nos. 1/2, pp. 237–245.) A system is described in which phase focusing is reduced, with consequent reduction of bunching; this leads to a diminution of field disturbances due to space charges, and hence to improved isotope resolution.

786/789 : 621.37/.38 **3068**

Electronic Music Synthesizer.—H. F. Olson & H. Belar. (*J. acoust. Soc. Amer.*, May 1955, Vol. 27, No. 3, pp. 595–612.) Description of an instrument for synthesizing all types of musical sounds from a coded paper record. Use of the arrangement for producing disk records is illustrated.

PROPAGATION OF WAVES

621.396.11 : 551.510.535 **3069**

Ionospheric Self-Interaction of Radio Waves.—F. H. Hibberd. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 268–279.) Theory suggests that powerful modulated continuous waves reflected by the E layer should exhibit a measurable degree of self demodulation. The effect is directly proportional to the power radiated and increases with decreasing frequency in the m.f. and l.f. bands. It should be possible to deduce the electron collision frequency in the layer. Effects near the gyrofrequency are not considered.

621.396.11 : 551.510.535 **3070**

Ionospheric Self-Interaction of Radio Waves at Vertical Incidence.—G. J. Aitchison & G. L. Goodwin. (*Nuovo Cim.*, 1st April 1955, Vol. 1, No. 4, pp. 722–725. In English.) Night-time transmissions were made from the University of Adelaide, using a carrier frequency of 1·55 Mc/s, which is close to the local gyrofrequency, modulated with a.f. in the range 160 c/s–4 kc/s. The ground wave and the reflected sky wave were received at a station 5·6 km to the south. Percentage modulation was determined from measurements of received r.f. and a.f. levels. Errors due to selective fading were eliminated. Similar tests were made on transmissions from broadcasting station 5CL Adelaide, 730 kc/s. The results show that for the 1·55-Mc/s carrier the modulation depths of both E-reflected and F-reflected waves were significantly less than that of the ground wave, whereas there was no reduction of modulation depth for the 730-kc/s carrier, this frequency being remote from the gyro-frequency. A tentative explanation is advanced in terms of differential absorption of the wave components.

621.396.11 : 551.510.535 **3071**

Experiments on the Interaction of Radio Waves in the Ionosphere.—M. Cutolo. (*Nuovo Cim.*, 1st April 1955, Vol. 1, No. 4, pp. 726–732.) Detailed reply to the points raised by Boella (245 of January).

621.396.11 : 551.510.535 **3072**

Measurement of the Nondeviative Absorption of Radio Waves in the Ionosphere.—P. Lejay, G. Pillet & R. Chezlemas. (*C. R. Acad. Sci., Paris*, 2nd May 1955, Vol. 240, No. 18, pp. 1745–1748.) Hourly records of the amplitude of 1 × F and 2 × F echoes of 3·4-Mc/s signals obtained at Domont are discussed; these exhibit both large fluctuations and slow variations at intervals of a few minutes. Statistical analysis based on a straightforward absorption formula indicates that these latter are due to variations of absorption as distinct from ionospheric focusing effects. Deduced hourly median values of absorption for December 1954 and January 1955 are shown; if a variation with zenith angle according to a $\cos^n$ law is assumed, the most likely value of n is about 0·3.

621.396.11 : 551.510.535 **3073**

Measurements of Limiting Polarization of Radio Waves reflected from the F Layer.—B. Landmark. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 284–286.) Measurements made at Kjeller, in Southern Norway, during May 1954, on F-layer echoes at near-critical frequency, do not confirm a previous suggestion that such echoes are linearly polarized.

621.396.11.029.53/.55 : 551.510.535 **3074**

Experimental Results of Oblique-Incidence Pulse Transmissions via the Ionosphere.—F. Delobeau, R. Eyfrig & K. Rawer. (*Ann. Télécommun.*, March 1955, Vol. 10, No. 3, pp. 55–64.) Transmissions between fixed stations in Europe, North America and West Africa were observed using a technique which determined the propagation time. Between Freiburg and Dakar (4 730 km), winter reception on both 11.4 Mc/s and 18·6 Mc/s was by multiple-hop F-layer propagation; mixed E- and F-layer propagation was important on 11·4 Mc/s; in summer, mixed-layer propagation on this frequency was observed only in the evening. Between Florida and Dakar (7 000 km) propagation at 1·95 Mc/s occurs only at night, in winter by multiple-hop E reflections; in spring and summer F reflections are occasionally received. Absorption in the D region prevents daytime propagation. Results are similar for transmission between the Faroes and Freiburg (1 500–1 700 km) on 1·95 Mc/s, but here E_s reflection is important. Observations of F_2-layer propagation over a 1 216-km ground path suggest that the 'M 3000' factor of the C.R.P.L. forecasts is really an 'M 2700' factor and that predicted values for m.u.f. are too low.

621.396.11.029.55/.62 : 551.510.535 **3075**

A Note on Factors affecting the Interpretation of Observations of Transient Echoes from the Ionosphere.—C. A. Shain & F. J. Kerr. (*J. atmos. terr. Phys.*, May 1955, Vol. 6, No. 5, pp. 280–281.) In the frequency range 10–100 Mc/s the echo rate determined by a receiver is inversely proportional to the square root of the cosmic-noise intensity. A correction is therefore necessary in observations of echoes from meteor-trail ionization to allow for the diurnal variation of cosmic noise. The effect may be used to determine the height at which increased absorption occurs in sudden ionospheric disturbances.

621.396.11.029.63/.64 **3076**

Reflection Coefficients of Irregular Terrain at 10 cm.—E. M. Sherwood & E. L. Ginzton. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 877–878.) Report of observations made in 1943, of reflections from homogeneous samples of various types of surface, including salt and fresh water, dry sand and soil, moist sand, dry soil with vegetation, and ice.

621.396.81 : 551.510.535 : 523.78 **3077**

A Note on Radio Field Strength Observations made at Ahmedabad during the Total Solar Eclipse on 30 June 1954.—R. G. Rastogi & R. M. Sheriff. (*J. sci. industr. Res.*, April 1955, Vol. 14A, No. 4, pp. 159–161.) Measurements on 15·07-Mc/s transmissions from London are discussed. Field strength is shown plotted against time of day for the eclipse day and for preceding and following control days. The most probable mode of propagation was the two-hop mode via the F_2 layer. An observed increase of signal strength during the eclipse period is probably due to decreased absorption in the lower layers of the ionosphere, mainly the F_1 layer.

621.396.812.3 **3078**

Probability of Fluctuations in Links between Points within the Visible Range.—T. Baldi. (*Ricerca sci.*, April 1955, Vol. 25, No. 4, pp. 808–827.) Analysis is presented for conditions in which a strong ground-reflected ray is to be expected. An expression is derived for the probability of the attenuation of the reflected ray exceeding a given amount relative to the direct ray, assuming random variation of the refractive-index gradient g. A formula established for the probability density of g is used to plot curves for comparison with experimental results.

RECEPTION

621.396.62 : 621.317.3 **3079**

Measurements on Radio Receivers.—Dehmelt, Frommer & Kronjäger. (See 3039.)

621.396.621.54 **3080**

A High Performance Battery Receiver.—(*Mullard tech. Commun.*, April 1955, Vol. 2, No. 11, pp. 17–27.) Details are given of a 7-valve superheterodyne receiver covering the frequency range 545 kc/s–24 Mc/s in four bands; it has one r.f. stage and a push-pull output stage delivering 425 mW for a voltage of 90 V and 1·2 W for 135 V.

621.396.621.54 : 621.314.7 **3081**

Multi-stage Transistor Superheterodyne.—C. L. Wright. (*Short Wave Mag.*, April 1955, Vol. 13, No. 2, pp. 69–75.) An all-transistor receiver designed to cover the 160-m and 80-m amateur bands is described in detail. Both point-contact and junction type transistors are used. The circuit comprises r.f. stage, Clapp local oscillator, mixer, two i.f. stages operating at 465 kc/s, detector voltage-doubler comprising two diodes, Clapp beat - frequency oscillator, grounded - collector a.f. matching stage, phase inverter and Class-B push-pull output stage. Complete circuit diagrams and tables of recommended components are given. Experiments are also very briefly mentioned on the application of magnetic bias for extending the frequency range of transistors to 30 Mc/s and on the development of a special mixer transistor with two emitters.

621.396.621.54.029.62 : 621.376.3 **3082**

Band-II F.M. Tuner Unit.—L. Hampson. (*Wireless World*, Aug. 1955, Vol. 61, No. 8, pp. 368–374.) Details are given of a design having one r.f. stage, oscillator-mixer, two i.f. stages and ratio detector, suitable for use with a wide range of a.f. amplifiers, including that described in 2245 of August (Ferguson).

621.396.828 : 621.316.8 **3083**

Resistors for Radio-Interference Suppression in Otto-Cycle [internal-combustion] **Engines.**—H. Henniger. (*NachrTech.*, April 1955, Vol. 5, No. 4, pp. 166–170.) The characteristics of various types of resistor are discussed. At present the inorganic solid-body resistor is the only type satisfying the requirements in respect of frequency, dielectric strength, temperature characteristics and absence of oxidation at high temperatures. A 5–10-kΩ, ½-W resistor, of dimensions 3·5 × 16 mm, is suitable in most applications; it may be incorporated in the spark plug. The discussion also mentions the applications of *LCR* suppressors and of damped λ/2 or λ/4 lines.

STATIONS AND COMMUNICATION SYSTEMS

621.376.5 : 621.39.001.1 **3084**

A Comparison between Delta and Pulse Code Modulation.—L. H. Zetterberg. (*Ericsson Tech.*, 1955, Vol. 11, No. 1, pp. 95–154.) Analysis is made on the basis of information theory, and with reference to the quality of speech transmission. The delta and p.c.m. systems have about equal information-transmitting capacity for an equal and reasonably large number of distinguishable signal levels. The amplitude distribution of the ideal signal for the delta system implies a signal power about 60% less than for the corresponding p.c.m. signal. The delta-modulation signal exhibits a spectral distribution in which the density decreases with increasing frequency. The two principal types of fault are overloading and granulation. For optimum signal/noise ratio, the delta system needs a much larger bandwidth than p.c.m. for moderate or high quality.

621.376.55 : 621.396.822.1 : 621.3.018.78 **3085**

Low-Frequency Crosstalk in Pulse-Phase Modulation.—J. G. Little. (*Wireless Engr*, Aug. 1955, Vol. 32, No. 8, pp. 220–223.) Conditions are considered for the passage of pulses through a single distorting network such as a coupling or decoupling circuit. The method of analysis is discussed in which the effect of low-frequency distortion on each component of the spectrum of a modulated pulse train is examined. A preferred method is to consider the waveform of a single pulse and to sum the effects of a series of disturbing pulses on a given disturbed pulse. The results give an indication of the order of low-frequency response necessary for the attainment of a given quality of transmission.

621.395.43 : 621.376.56 **3086**

Pulse-Code-Modulation Multiplex Telephone Transmission System.—P. Herreng, R. Blondé & G. Dureau. (*Câbles & Transm.*, April 1955, Vol. 9, No. 2, pp. 144–160.) Equipment designed by the Société Alsacienne de Constructions Mécaniques uses binary coding effected by a c.r. tube of special construction; preliminary 32-level quantization of the signal is effected by a method eliminating feedback with consequent advantages in coding speed. The signal transmitted is a five-pulse combination. Decoding is performed by comparing the stored received signal with a complete pulse sequence identical with that generated at the transmitter, using a specially constructed coincidence detector.

621.395.44 : 621.315.052.63 **3087**

Guide to Application and Treatment of Channels for Power-Line Carrier.—(*Trans. Amer. Inst. elect. Engrs*, Part III-A, *Power Apparatus and Systems*, June 1954, Vol. 73, pp. 417–435. Discussion, pp. 435–436.) A committee report presenting data and discussion relevant to the development of adequate and reliable carrier-current channels.

621.396.41 : 621.396.65 **3088**

Protection of Service in the TD-2 Radio Relay System by Automatic Channel Switching.—I. Welber, H. W. Evans & G. A. Pullis. (*Bell Syst. tech. J.*, May 1955, Vol. 34, No. 3, pp. 473–510.) One of the six two-way channels is reserved for use as a substitute in case of interruption or severe degradation of transmission in the other channels. The operation and circuits of the protection system are described in detail.

621.396.41 : 621.396.82 **3089**

Interchannel Interference in FM and PM Systems under Noise Loading Conditions.—W. R. Bennett, H. E. Curtis & S. O. Rice. (*Bell Syst. tech. J.*, May 1955, Vol. 34, No. 3, pp. 601–636.) Frequency-division systems with a large number of channels are considered and analysis is given using a band of random noise to represent the multiplex signal. Interchannel interference due to variation of attenuation and phase shift with frequency is estimated from the effect produced by echoes of relatively small amplitude. Curves are presented for computing the interference power.

621.396.66 **3090**

Operational Measurements on U.S.W. [f.m.] **Broadcast Transmitters: Part 3.**—L. Merkl. (*Arch. tech. Messen*, Feb. 1955, No. 229, pp. 31–32.) Noise measurements are discussed. Parts 1 and 2: 1789 of June.

621.396.66 **3091**

Comparative Measurements with Volume-Meter and Peak-Value Meter for Monitoring Broadcast Transmissions.—E. A. Pavel, A. Gastell & M. Bidlingmaier. (*Fernmeldetech. Z.*, April 1955, Vol. 8, No. 4, pp. 205–212.) The comparison shows that for monitoring modulation depth the peak-value meter is more satisfactory. For high accuracy the integration time of the meter should be ≯ 10 ms.

SUBSIDIARY APPARATUS

621.311.6 : 621.314.63 : 546.28 : 535.215 **3092**

Silicon Solar-Energy Converters.—M. B. Prince. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 534–540.) Theory of operation of the Si junction photodiode is given and compared with experimental data. Si is shown to be the most efficient semiconductor available for conversion of solar energy. A design is discussed in which the radiation is incident on the *n* layer; the thickness of the *p* layer is required to be low to give low resistance, but not so low that minority carriers recombine before diffusing to the junction. Resistance at the metal contacts must be kept as low as possible. Conversion efficiencies of 6% have been attained. Possibilities are indicated of improving the efficiency by use of non-reflecting coatings or auxiliary mirrors and lenses.

621.311.62 : 621.316.722.1 **3093**

Regulated D.C. Power Supplies at Low Voltages.—R. K. Hayward, J. C. Jennings & R. C. Barker. (*Electronic Engng*, July 1955, Vol. 27, No. 329, pp. 304–307.) A valve-stabilized unit with d.c. output 250 mA at 50 V or 150 mA at 100 V is described, as well as a unit using Ge-junction rectifiers. The limitations of cold-cathode-tube stabilizers are discussed.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **3094**

The London/Isle-of-Wight Television Link, Stage One.—T. Kilvington. (*P. O. elect. Engrs' J.*, April 1955, Vol. 48, Part 1, pp. 36–38.) "The initial television service to the Isle of Wight has been provided by direct pick-up of signals from the London transmission on receivers sited near Alton, Hants, and thence by transmission over a 40-mile microwave link to Rowridge, I.o.W., where it is radiated from a B.B.C. transmitter."

621.397.5 : 535.623 **3095**

Transmitting Colour Information.—(*Wireless World*, Aug. 1955, Vol. 61, No. 8, pp. 393–396.) The effects on transmitting and receiving techniques of modifications to the American N.T.S.C. system incorporated in the experimental 'British N.T.S.C.' system are explained. The system envisaged by the B.B.C. has the advantage that the same transmissions will cater both for simple receivers recovering narrow-band signals and for more elaborate receivers recovering wide-band signals and giving high-definition colour reproduction. See also *ibid.*, p. 355, for details of the standards used by the B.B.C.

621.397.6 **3096**

New Design in Closed-Circuit Television.—A. V. J. Martin. (*Tele-Tech & Electronic Ind.*, April 1955, Vol. 14, No. 4, Section 1, pp. 94–96 . . 133.) English version of article noted in 1499 of May.

621.397.6.001.4 : 535.623 **3097**

Color-Video Envelope-Delay Measurement.—R. C. Kennedy & H. French. (*Electronics*, June 1955, Vol. 28, No. 6, pp. 144–148.) Description of a test set, comprising transmitter and calibrated distant receiver, and technique for determining the phase-shift of the N.T.S.C. colour-picture signal.

621.397.611.2 **3098**

Development and Operation of the Rieseliko [supericonoscope with stabilizing electron spray].—F. Michels. (*Fernmeldetech. Z.*, May 1955, Vol. 8, No. 5, pp. 269–272.) A tube operating on the principles described e.g. by Cope et al. (2632 of 1952) is discussed. Spurious picture signals are eliminated by generating a space charge of required density and by providing border electrodes. A method is also described for suppressing hum interference produced when the photocathode supplying the electron spray is illuminated by pulsating sources.

621.397.62 : 535.623 **3099**

Designing TV Tuners for Color Receivers.—F. Schor. (*Tele-Tech & Electronic Ind.*, April 1955, Vol. 14, No. 4, Section 1, pp. 80-81 . . 154.) The effects of unevenness of response curve, mismatching and oscillator frequency drift are discussed. If oscillator drift is < 60 kc/s a tuner correctly designed for monochrome reception will give good results for colour television, but tuning is more critical.

621.397.62 : 535.623 : 535.88 **3100**

Large-Screen Color-Television Projection.—L. L. Evans & R. V. Little, Jr. (*J. Soc. Mot. Pict. Telev. Engrs*, April 1955, Vol. 64, No. 4, pp. 169–173. Discussion, p. 173.) Description of apparatus producing a picture 15 ft × 20 ft and operating on F.C.C. standards.

621.397.62 : 535.88 **3101**

A Design for Scanning and E.H.T. Generators to operate a Television Projection System from 170-V H.T. Supply.—E. F. Wale. (*J. Brit. Instn Radio Engrs*, June 1955, Vol. 15, No. 6, pp. 315–326.) The design of a receiver without a mains transformer is discussed. The most practical method is to combine high-voltage pulses from the line output circuit and from a separate h.v. generator. Details are given of a time-base unit with two h.v. rectifiers providing an output of 25 kV over a current range 0–250 μA. A comparison of components used shows that a considerable reduction in the cost of production as against that of a conventional circuit should be realized.

621.397.62.001.4 **3102**

Methods for Measurement of Selectivity and Delay Characteristics of Television Receivers.—H. J. Griese. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 167–170.) Methods are described for determining group delay and phase characteristics without modifying the receiver under test.

621.397.621.2 : 535.623: 621.385.832 **3103**

Development of the RCA 21-Inch Metal-Envelope Color Kinescope.—H. R. Seelen, H. C. Moodey, D. D. VanOrmer & A. M. Morrell. (*Elect. Engng, N.Y.*, April 1955, Vol. 74, No. 4, pp. 330–335.) See 2771 of September.

621.397.8 **3104**

Television Picture Definition.—W. Dillenburger. (*Fernmeldetech. Z.*, April 1955, Vol. 8, No. 4, pp. 213–221.) A circuit is described for correcting the frequency characteristic of the pick-up tube so as to maintain the picture definition at 100% for video frequencies up to 5 Mc/s, as required for the C.C.I.R. 625-line system. Tests with a supericonoscope and with a superorthicon are reported; the improvement due to the equalizer was noticeable on test transmissions but not on programme transmissions. The effect on signal/noise ratio of using the equalizer was also investigated.

621.397.8 : 535.623 **3105**

Flicker in Frame Sequences in Television.—P. Billard. (*Rev. d'Optique*, March 1955, Vol. 34, No. 3, pp. 129–149.) Experiments were made to determine the characteristics of a colour-television system combining the greatest possible bandwidth economy with absence of perceptible flicker; the persistence of red, green and blue phosphors was simulated by an appropriate lamp-and-filter system in conjunction with graded-density film. The critical repetition frequency depends little on the type of scanning sequence used; for the relatively-short-persistence blue it is much lower than for the relatively-long-persistence red and green; for the latter, visible flicker is suppressed at 43 frames/sec at a luminance level of 30 nt. Red and green signals should receive equal treatment, whether with simultaneous or with binary alternating presentation.

VALVES AND THERMIONICS

537.5 : 538.56 **3106**

Plasma Ion Oscillations in Electron Beams.—K. G. Hernqvist. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 544–548.) "The frequency of the oscillations observed in ion-neutralized electron streams such as that of an ion-trapping gun or of a tetrode has been shown to agree well with the Langmuir-Tonks theory for plasma ion oscillations. The existence of a dipole mode of oscillation in addition to the longitudinal mode has been observed for a plasma column. A mechanism is proposed for the excitation of these self-sustained oscillations by which the secondary electron current from electrodes bounding the plasma is modulated by the vibration of the ions in such a way as to deliver energy to the a.c. field associated with the ion oscillations. Experimental observations verify this picture as far as the source of energy is concerned."

621.314.63 : 535.215 **3107**

'Gate Modulation' of Electromagnetic Radiation.—K. Lehovec. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 495–496.) The space-charge region in the vicinity of a semiconductor *p-n* junction acts as a gate for light incident parallel to the plane of the junction, the gate width depending on the value of an applied blocking voltage. The effect is based on the dependence of the semiconductor absorption on the concentration of free carriers. A proposal to use the principle in the construction of an infrared diffraction grating is mentioned.

621.314.63 : 621.317.7 **3108**

Some Applications of the Nonlinear Characteristic of Germanium Crystal Diodes.—P. Koch. (*Bull. schweiz. elektrotech. Ver.*, 16th April 1955, Vol. 46, No. 8, pp. 361–372.) The theoretically predicted logarithmic characteristic has been confirmed in commercial diodes. Square-law or other desired special characteristics are obtained by combining diodes. Descriptions are given of a ratiometer and of a modulator designed on the basis of these characteristics. Noise voltage is 5–8 times as great as the value calculated from the diode resistance, with loads up to about 150 mV per diode.

621.314.7 **3109**

The Transistor: Part 5—Properties and Limitations.—J. R. Tillmann & F. F. Roberts. (*P.O. elect. Engrs' J.*, April 1955, Vol. 48, Part 1, pp. 43–47.) The properties are explained in terms of the transistor structure. Production techniques for improving frequency range, switching speed, power capacity, reliability and ability to operate at high temperature are discussed. Part 4: 2464 of August (Yemm & Carasso).

621.314.7 **3110**

A Two-Emitter Transistor with a High Adjustable Alpha.—R. F. Rutz. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 834–837.) The enhancement of the current amplification of a point-contact transistor on adding a second emitter is attributed to internal positive feedback which varies the hole-transport factor associated with the second emitter as the first-emitter current is varied. The effect of varying the spacing between second emitter and collector is also discussed and experimental results are reported.

621.314.7 **3111**

The Effects of Junction Shape and Surface Recombination on Transistor Current Gain: Part 2.—K. F. Stripp & A. R. Moore. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 856–866.) Continuation of work reported by Moore & Pankove (2797 of 1954). Analytical expressions are derived for the collector-to-base current amplification factor, taking account of surface and volume recombination, for grown-junction transistors with rectangular and round cross-section and for alloyed-junction types. The expressions become simpler when volume recombination is neglected, which is justifiable in most practical cases. Parameters involved including a geometrical figure of merit, are evaluated for alloyed-junction types, using a three-dimensional electrolytic analogue. The highest figure of merit is obtained by combining a flat emitter junction with a collector penetrating not less than a critical distance into the base.

621.314.7 : 621.317.733 **3112**

A Bridge for measuring Audio-Frequency Transistor Parameters.—Cooper. (See 3051.)

621.314.7 : 621.372.5 **3113**

Design Considerations of Junction Transistors at Higher Frequencies.—R. A. Pucel. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 878–879.) Theory given previously [583 of February (Statz et al.)] is extended to derive a form of the equivalent T network applicable down to zero frequency.

621.314.7 : 621.396.621.54 **3114**

Multi-stage Transistor Superheterodyne.—Wright. (See 3081.)

621.38.032.7.002.2 **3115**

Ceramic-to-Metal Sealing: its Development and Use in the American Radio Valve Industry.—D. E. P. Jenkins. (*Electronic Engng*, July 1955, Vol. 27, No. 329, pp. 290–294.) A review of literature. 55 references, including patents and special reports.

621.383.2 **3116**

Behaviour of Vacuum Photocells illuminated by Light Pulses.—W. Kluge & S. Weber. (*Z. angew. Phys.*, March 1955, Vol. 7, No. 3, pp. 126–131.) Ag-Cs$_2$O-Cs and SbCs-Cs photocells were illuminated by single and repeated light pulses of duration about 17 μs at an intensity up to $4{\cdot}9 \times 10^7$ lux. The former showed no signs of fatigue until the mean cathode current exceeded a value between 1 and 5 μA/cm^2, the value depending on the particular cathode structure. Recovery could be accelerated by means of infrared illumination. The transparent SbCs-Cs photocells were found to be less suitable in light-pulse applications.

621.383.27 **3117**

Theory of Operation of the Last Stage of a Photomultiplier.—P. Leuba. (*J. Phys. Radium*, April 1955, Vol. 16, No. 4, pp. 296–303.) Assuming constancy of photocathode sensitivity and of multiplication factor, linearity is achieved in the final stage by making the time constant of the associated circuit large compared with the duration of the input pulse and by ensuring that all electrons emitted by the final dynode reach the collector electrode. To achieve this it is necessary that the final stage is not space-charge limited, that the transit time of electrons across it is small compared with the pulse duration, and that the pulse shape is regular.

621.385 : 621.396.822 **3118**

Investigations of Electron Streams.—J. Müller. (*Z. angew. Math. Phys.*, 15th May & 15th Sept. 1954, Vol. 5, Nos. 3 & 5, pp. 203–232 & 409–419.) Phenomena in controlled beams are analysed by means of perturbation theory based on the laws of conservation of energy and charge. Matrix formulation is used. Nyquist's noise formula is derived for a system in thermal equilibrium, with a potential minimum in the beam and large transit angles. Noise formulae are also presented for a system not in thermal equilibrium.

621.385:621.396.822 **3119**

Cross Correlation between Velocity and Current Fluctuations in Tube Noise.—S. V. Yadavalli. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 605–608.) Correlation between the velocity and current fluctuations in an electron stream at the entrance plane is shown to be zero under stated conditions. See also 301 of January.

621.385.029.6 **3120**

Backward-Wave Oscillator Efficiency.—R. W. Grow & D. A. Watkins. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, pp. 848–856.) "The dependence of power output upon space charge, circuit loss, beam thickness, velocity spread, and circuit mismatches is determined by a combination of theoretical and empirical means. In addition, the effect of circuit mismatches upon the starting current and frequency is discussed."

621.385.029.6 **3121**

Variation of High-Frequency Admittance of a Multisegment Magnetron in the Oscillating State.—H. Fricke. (*Fernmeldetech. Z.*, April 1955, Vol. 8, No. 4, pp. 186–192.) The operation of the magnetron is explained in relation to an approximate calculation of the admittance diagram. Discussion of the electron paths is referred to a plane equivalent system in which the bunched electrons interact with the h.f. field only in the vicinity of the slots. Both capacitive and inductive reactances may occur. As the anode voltage is varied, the resistive and reactive admittance components vary simultaneously, producing variations of both amplitude and frequency of the oscillations. The influence on the admittance of the magnetic field, the oscillation mode, and the number of slots is also indicated. The theoretical results are supported by measurements and by results of other workers.

621.385.029.6 : 621.3.012 **3122**

Graphical Determination of Reflex-Klystron Characteristics.—J. Bruijsten. (*Philips Res. Rep.*, April 1955, Vol. 10, No. 2, pp. 81–96.) A triangular diagram of normalized efficiency as a function of resonator loss conductance, load conductance and small-signal electronic conductance is derived from the variation of normalized efficiency with bunching parameter. Conditions under which the diagram is valid are discussed; it can be used for constructing curves relating the power parameter to the electronic tuning parameter for non-reactive and reactive loads, or alternatively for evaluating the parameters from experimental data.

621.385.029.6 : 621.396.822 **3123**

Noise in One-Dimensional Electron Beams.—H. A. Haus. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 560–571.) Conditions in long-beam microwave valves are considered; general theory of the noise in such beams is developed based on use of a reference plane other than that of the beam potential minimum and selected so that the assumption of uniform transverse distribution of electron velocity is valid at and beyond this plane. Analogies with network theory are used in the analysis; transformations of the noise standing wave by means of 'lossless beam transducers' constituted by the region between the reference plane and the drift space are discussed. Expressions are derived for the minimum obtainable noise figures of a velocity-jump amplifier, a klystron and a travelling-wave valve. It is shown that these noise figures cannot be reduced by using 'lossy beam transducers'.

621.385.029.65 **3124**

A Tunable, Low-Voltage Reflex Klystron for Operation in the 50–60-kMc/s Band.—E. D. Reed. (*Bell Syst. tech. J.*, May 1955, Vol. 34, No. 3, pp. 563–599.) A detailed description is given of the Type-M1805 valve, which delivers c.w. power of 15–30 mW at a beam voltage of 600 V and has a mechanical tuning range > 10 kMc/s. Features specially studied include the high-convergence gun and the development of an efficient passive circuit consisting of cavity and wide-band output coupling system. Grids used at the interaction gap are of tungsten ribbon with a thickness transverse to the beam of 0·0003 in. and a width of 0·003–0·004 in. in the direction of electron flow. The valve is free from electron hysteresis, indicating either that few electrons reach the interaction gap for a third time or that those which do are no longer bunched.

621.385.032.216 **3125**

Improved 'Impregnated Cathode'.—R. Levi. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, p. 639.) Improvements in the cathode described in *Le Vide*, Nov. 1954, Vol. 9, No. 54, pp. 284–289 are indicated.

621.385.2 + 621.385.029.6 **3126**

Noise at the Potential Minimum in the High-Frequency Diode.—D. A. Watkins. (*J. appl. Phys.*, May 1955, Vol. 26, No. 5, pp. 622–624.) Analysis is presented based on the assumption that the transit angle between cathode and potential minimum is small compared with that between potential minimum and anode. The mean-square convection current is found to be about half full shot noise for a typical case and the mean-square velocity is found to be the same as in the temperature-limited case. Application of this result to an analysis of the minimum obtainable noise figure of klystrons and travelling-wave tubes using velocity-jump noise reduction shows that their noise figure can be reduced without theoretical limit by increasing the current density at the cathode.

MISCELLANEOUS

621.37/.39].004.6 : 623 **3127**

Maintainability of Services Equipment.—(*J. Brit. Instn Radio Engrs*, June 1955, Vol. 15, No. 6, pp. 283–307. Discussion, pp. 307–313.)

Part 1 (pp. 283–290).—G. W. A. Dummer.
Summarized analysis of faults in electronic equipment reported to the Ministry of Supply during the period 1950–1953, and discussion of design and constructional techniques for improving reliability and ease of maintenance.

Part 2 (pp. 290–298).—R. B. Brenchley.
Part 3 (pp. 299–303).—G. C. Godfrey.
Part 4 (pp. 303–307).—A. J. B. Naish.
Outline descriptions of Army, Royal Air Force and Royal Navy maintenance systems and equipment design and test requirements.

621.38 : 53 **3128**

Advances in Electronics and Electron Physics, Vol. VI. [Book Review]—L. Marton (Ed.). Publishers: Academic Press, New York, 1955, 518 pp., $11.80. (*Proc. Inst. Radio Engrs*, July 1955, Vol. 43, No. 7, p. 898.) Surveys are presented of metallic conduction at high frequencies and low temperatures, relaxation processes in ferromagnetism, physical properties of ferrites, space-charge-limited currents, comparison of analogous semiconductors and gaseous electronic devices, the electron microscope, travelling-wave valves and paramagnetism.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 + 538.566 **3129**

General Relation between Absorption and Dispersion of Sound Waves.—V. L. Ginzburg. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 31–39.) The theoretical discussion presented includes a comparison with the case of e.m. waves.

534.2 + 538.566] : 535.43 **3130**

The Scattering of a Scalar Wave by a Semi-infinite Rod of Circular Cross Section.—Jones. (See 3237.)

534.213-8 **3131**

Absorption of Underwater Sound by Substances in Process of Solution.—R. D. C. Reed & T. S. McLeod. (*Nature, Lond.*, 7th May 1955, Vol. 175, No. 4462, pp. 809–810.) Measurements at ultrasonic frequencies indicate that very high absorption is produced by solids in process of solution. The results are consistent with the evolution of minute gas bubbles.

534.222.1 **3132**

A Particular Form of Attenuation in Propagation of Waves in Stratified Media.—L. M. Brekhovskikh & I. D. Ivanov. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 23–30.) Propagation in a medium with properties as noted in 296 of 1954 (Brekhovskikh) is considered theoretically with reference to a particular case. The effect of losses due to refraction is taken into account. As shown in fig. 2, the decrease of sound intensity is a function of a parameter S; the larger the value of S, the more closely is the attenuation proportional to the inverse square of the distance.

534.232-8 **3133**

Calculation of Gain of Cylindrical [ultrasonic] **Sound-Focusing Systems.**—L. D. Rozenberg. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 70–77.) See also 2284 of 1954.

534.232 : 546.431.824-31 **3134**

Thickness Vibrations of Polarized Plates of Barium Titanate.—I. P. Golyamina. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 40–47.) Experimental results indicate that the secondary peaks in the electrical-impedance/frequency curve depend on the geometry of the plate and the mean parameters of the material, the effect of inhomogeneities being small. The frequency characteristics of the electrical impedance and sound intensity radiated are simply related (figs. 8 and 9).

534.24 **3135**

Scattering of Sound by a Plane Nonuniform Surface with Periodically Varying Acoustic Conductivity.—Yu. P. Lysanov. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 58–69.) The scattering is calculated assuming that the acoustic conductivity of the reflecting surface is real and independent of the angle of incidence. The solution is obtained in the form of a series, the r^{th} term of which is given by a recurrence formula. The results can also be applied in the study of e.m. waves.

534.26-8 **3136**

Experimental Investigation of Diffraction of Acoustic Waves by Periodic Structures.—A. N. Leporski. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 48–57.) Results of experiments on the diffraction of ultrasonic waves by underwater surfaces with sinusoidal or saw-tooth profiles are in good agreement with results calculated from Brekhovskikh's theory (2968 of 1953). Short pulses of vibrations of frequencies of the order of a few hundred kc/s were used. The automatic equipment, used in conjunction with a c.r.o. indicator, for plotting the diffraction pattern is described.

534.76/.77 **3137**

Contribution to the Theory of Binaural Hearing.—O. Schäfer & H. Schlitt. (*Z. angew. Phys.*, April 1955, Vol. 7, No. 4, pp. 165–168.) Experimental results indicate that improved intelligibility can be obtained with a sound transmission system by the use of two sound inputs, spaced apart a distance $d \geqslant 20$ cm and feeding in parallel into a single-ended output. The improvement corresponds to a change of the resultant sound envelope, oscillograms of which are shown; as d increases, the apparent reverberation decreases and the intelligibility increases. At $d \simeq 50$ cm intelligibility of the order of that for normal binaural hearing is obtained. Persons totally deaf in one ear, when using a hearing aid with two input microphones, noticed a great improvement.

534.84 **3138**
Acoustics of Low Rooms and Tunnels.—J. Brillouin. (*C. R. Acad. Sci., Paris,* 6th June 1955, Vol. 240, No. 23, pp. 2210–2212.) Observations indicate that in large rooms with low ceilings, and in tunnels, with diffuse reflection of sound, the intensity level in db decreases linearly as a function of distance from the source. The theoretical basis of this observation is discussed and an expression is derived for the proportionality factor involved.

534.861.1 : 534.845 **3139**
Panel Resonators as Acoustic Low-Frequency Absorbers.—A. Lauber. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.,* 1st May 1955, Vol. 33, No. 5, pp. 192–197. In German.) Investigations are reported of several types of resonator comprising a box structure with an open side mounted against the wall, and containing a porous glass-fibre damping plate. Absorption measurements preliminary to studio tests were made using a Kundt's tube, and in one case a reverberation chamber. Extra mass was added to the front plate to lower the resonance frequency. Reverberation-time/frequency characteristics are shown for a studio of volume 200 m^3 before and after introduction of absorbers. Greater absorption is obtained at low frequencies than with a perforated acoustic panel attached directly to the wall.

621.395.623.7.018.7 : 534.862.6-6 **3140**
Measurement of Nonlinear Distortion in Loudspeakers by a Subsonic-Modulation Method.—B. G. Belkin. (*Akust. Zh.,* Jan./March 1955, Vol. 1, No. 1, pp. 12–22.) In this modification of the intermodulation method a modulation frequency of the order of 1 c/s is used. The principal advantage lies in the possibility of testing loudspeakers having a strongly frequency-dependent response characteristic. Circuit diagrams of the test equipment are shown and test results are presented graphically.

621.395.625.3 **3141**
A Flux-Sensitive Reproducing Head for Magnetic Recording Systems.—E. D. Daniel. (*Proc. Instn elect. Engrs,* Part B, July 1955, Vol. 102, No. 4, pp. 442–446.) Description of a head whose efficiency is independent of signal frequency over the working range, and of the speed of the recording medium; it is useful for special applications, including the investigation of very-low-frequency signals.

AERIALS AND TRANSMISSION LINES

621.372 **3142**
Tapered Velocity Couplers.—J. S. Cook. (*Bell Syst. tech. J.,* July 1955, Vol. 34, No. 4, pp. 807–822.) Use of graduated-pitch helices to provide distributed coupling between transmission lines makes possible very-wide-band directional couplers for microwave apparatus. The idea is particularly useful for coupling into and out of travelling-wave valves; in other applications the physical length involved may be a limiting factor.

621.372 **3143**
Wave Coupling by Warped Normal Modes.—A. G. Fox. (*Bell Syst. tech. J.,* July 1955, Vol. 34, No. 4, pp. 823–852.) A generalization of the work on very-wide-band couplers described in 3142 above. The distribution of power over the output end of a coupled waveguide system may be controlled as desired by gradual warping of the normal-mode field patterns along the coupler. The principle applies to dielectric waveguides, birefringent media and waveguides containing ferrite.

621.372 **3144**
Analysis of the Single Tapered Mode Coupler.—W. H. Louisell. (*Bell Syst. tech. J.,* July 1955, Vol. 34, No. 4, pp. 853–870.) Operation of the devices discussed in 3142 and 3143 above is analysed. A criterion is derived for the permissible variation in the line parameters for a given bandwidth. Parameters facilitating representation of performance are introduced.

621.372.2 **3145**
On the Surface Impedance of a Corrugated Waveguide.—A. E. Karbowiak. (*Proc. Instn elect. Engrs,* Part B, July 1955, Vol. 102, No. 4, pp. 501–502.) Experimental results reported by Barlow & Karbowiak (2301 of 1954) are discussed. An empirical modification to the theoretical formula for the surface impedance is derived which is applicable for all values of surface parameters, provided that the corrugation pitch is less than about $\lambda/4$.

621.372.2 + 621.396.67].01 **3146**
A Hydraulic Model for Representation of Time-Varying Processes in Long Electrical Lines and Aerials.—E. Prenzel. (*Arch. elekt. Übertragung,* May 1955, Vol. 9, No. 5, pp. 237–240.)

621.372.21 **3147**
A Double-Ground-Plane Strip-Line System for Microwaves.—B. A. Dahlman. (*Proc. Instn elect. Engrs,* Part B, July 1955, Vol. 102, No. 4, pp. 488–492.) General theory and design principles are given for microstrip lines comprising a strip of Cu foil between sheets of low-loss dielectric, the outer faces of which are covered with conducting sheets.

621.372.22 : 621.372.51 **3148**
Parabolic Transmission Line.—R. F. H. Yang. (*Proc. Inst. Radio Engrs,* Aug. 1955, Vol. 43, No. 8, p. 1010.) A matching section in which the characteristic impedance varies parabolically along the line is proposed as a preferable alternative to the hyperbolic line described by Scott (327 of 1954).

621.372.552 : 621.397.241 **3149**
Equalization of Cables for Local Television Transmission.—P. W. Rounds & G. L. Lakin. (*Bell Syst. tech. J.,* July 1955, Vol. 34, No. 4, pp. 713–738.) Description of methods adopted for matching cable impedance and loss characteristics in the design of fixed and adjustable equalizers used in the A2A transmission system (3412 below).

621.372.8 **3150**
Standard Waveguides and Couplings for Microwave Equipment.—A. F. Harvey. (*Proc. Instn elect. Engrs,* Part B, July 1955, Vol. 102, No. 4, pp. 493–500.) An account is given of the development and standardization of waveguides, couplings and adaptors intended primarily but not exclusively for Service equipment. A discussion on finishing and packing waveguide parts is included. 41 references.

621.372.8 **3151**
Surface Currents and Finite-Conductivity Waveguides.—P. Baudoux. (*Rev. HF, Brussels,* 1955, Vol. 3, No. 1, pp. 17–26.) A new vector is introduced whose contour integral gives the density of the surface current.

This vector, which satisfies a two-dimensional continuity equation, is identified with the tangential discontinuity of the magnetic field at the surface. A specially adapted form of Ohm's law is used to express the relations between dissipated and transmitted power. The theory is applied to waveguides.

621.372.8 **3152**

Impedance of Open- and Closed-Ridge Waveguide.—T. G. Mihran. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 1014–1015.) A comparison of recent measurements with calculations made by Cohn (23 of 1948) and Mihran (2425 of 1949) confirms that the accuracy of the calculated values is improved by including a term taking account of power flow along the discontinuity capacitance.

621.372.8 **3153**

Analogue of a Birefringent Quarter-Wave Plate for a Wavelength of 3·2 cm.—G. Raoult, R. Fanguin & A. Marcon. (*C. R. Acad. Sci., Paris*, 27th June 1955, Vol. 240, No. 26, pp. 2497–2500.) Consideration of $H_{1,1}$-mode propagation in a circular waveguide indicates that the energy is largely concentrated near the axis. On this basis it is possible to design units containing conducting or dielectric plates arranged longitudinally and shaped so as to produce a 90° phase difference between waves polarized perpendicular and parallel to the plane of the plate, but such units require very accurate construction. Rectangular waveguide sections are therefore used in preference, the ends of each wall being tapered to join the circular waveguide sections.

621.372.8 : 512 **3154**

Infinite Systems of Linear Algebraic Equations connected with Problems of Semi-infinite Periodic Structures.—Ya. N. Fel'd. (*C. R. Acad. Sci. U.R.S.S.*, 11th May 1955, Vol. 102, No. 2, pp. 257–260. In Russian.) The application of the equations derived is illustrated by analysing the propagation of an H_{10} wave in a waveguide of cross-section $a \times b$ (where $a > b$) containing an infinite row of metallic rods of length b, spaced l apart, in the plane of symmetry perpendicular to side a.

621.372.8 : 621.317.3 **3155**

Measurements in Travelling-Wave Structures.—A. W. Aikin. (*Wireless Engr*, Sept. 1955, Vol. 32, No. 9, pp. 230–234.) The characteristics of corrugated waveguides, such as the disk-loaded type used in linear accelerators, are investigated by field-perturbation methods derived from those used previously for resonant cavities.

621.372.8 : 621.384.622.2 **3156**

Phase Velocity and Shunt Impedance of a Waveguide with Helix for a Linear Proton Accelerator (for Energy about 50 MeV).—A. Septier. (*C. R. Acad. Sci., Paris*, 27th June 1955, Vol. 240, No. 26, pp. 2500–2502.) Continuation of work reported previously (927 and 928 of April). The design of the second waveguide section is discussed. The ratio of shield diameter to helix diameter was chosen to improve the maximum shunt impedance.

621.396.67.012.12 **3157**

Vertical Pattern of V.H.F. Aerials.—E. G. Hamer. (*Wireless World*, Sept. 1955, Vol. 61, No. 9, pp. 452–454.) The diagram is obtained from field-strength measurements taken with the aerial lying horizontally above a large ground-plane. Polar diagrams of various v.h.f. aerials tested are shown. See also 3480 of 1953.

621.396.674.1 : 621.318.134 **3158**

Loop Aerials using Ferrites.—J. Dupuis. (*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 379–393.) The characteristics of loop aerials wound on ferroxcube cores are discussed and constructional details are given.

621.396.676.029.6 : 621.3.049.75 **3159**

Photoetched Antennas for Supersonic Aircraft.—D. J. Sommers. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 130–133.) A three-plate shielded-strip transmission line, made up by photoetching a centre strip on the inside faces of two dielectric sheets each of which has copper foil bonded to both surfaces, has a slot array etched in the outer face, thus providing a microwave aerial suitable for flush mounting in the skin of aircraft.

621.396.677.71 **3160**

Calculated Radiation Characteristics of Slots cut in Metal Sheets.—J. R. Wait & R. E. Walpole. (*Canad. J. Technol.*, May 1955, Vol. 33, No. 3, pp. 211–227.) Calculations are made for a longitudinal slot in an elliptical cylinder with large eccentricity. Radiation patterns are presented for symmetrical and asymmetrical configurations. The radiation conductance is a periodic function of the major axis, for a given wavelength. The calculations are extended to the case of the semi-infinite plane sheet. Diffraction by a feed waveguide at the back of the slot is not a serious source of error as long as the sheet is at least twice as wide as the larger dimension of the guide.

621.396.677.73 **3161**

Design of Microwave Gain-Standard Horns.—W. T. Slayton. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 150–154.) Design and constructional data are given for e.m. horns for the wavelength range 0·77–31·5 cm which have been adopted as standards by the U.S.A. Inter-Service Antenna Group.

621.396.677.83 **3162**

Wide-Angle Radiation in Pencil-Beam Antennas.—D. Carter. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 645–652.) Reflector-type aerials are considered. Undesired wide-angle radiation is contributed by the primary radiator and by scattering from the reflector. Approximate methods of calculating these contributions are discussed; the case of the paraboloidal reflector is treated in detail. Results are presented graphically in a form useful for design purposes.

621.396.677.859 : 621.315.612 **3163**

Ceramic Radomes for Aircraft.—P. S. Hessinger. (*Amer. ceram. Soc. Bull.*, 15th May 1955, Vol. 34, No. 5, pp. 145–150.) Mechanical, thermal and electrical properties required in materials for radomes are discussed in relation to the possibility of using ceramics. Some experimental sandwich structures show promise.

AUTOMATIC COMPUTERS

681.142 **3164**

Review of Electronic Computer Progress during 1954.—D. R. Brown. (*Trans. Inst. Radio Engrs*, March 1955, Vol. EC-4, No. 1, pp. 33–38.)

681.142 **3165**

A Commercial Electronic Calculator.—W. Woods-Hill. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 332–337.) The main features common to three business accounting machines are briefly described. The method of performing the four basic arithmetic functions is illustrated by worked examples. See also 2206 of August.

681.142 **3166**

A Miniature Analogue Computer.—A. B. Johnson. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 348–349.) The computer described is capable of solving linear differential equations of orders up to the tenth, and is intended for preliminary design investigations and educational purposes.

681.142 **3167**

Electrical Analog Computing Machine for solving Linear Equations and Related Problems.—S. K. Mitra. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 453–457.) A computer for solving equations with ten variables by a new iteration method is described. In addition to the solution, the machine gives the largest eigenvalue of the matrix of the linear system.

681.142 **3168**

A High-Speed Permanent Storage Device.—J. M. Wier. (*Trans. Inst. Radio Engrs*, March 1955, Vol. EC-4, No. 1, pp. 16–20.) A digital computer storage system is described using a magnetic-core matrix [59 of 1954 (Rajchman)] in combination with the threaded-core system used in the Bell Computer Model VI. The capacity is about a million bits.

681.142 : 512 **3169**

Linear Algebraic Computation by Multi-winding Transformers.—F. L. Ryder. (*J. Franklin Inst.*, May 1955, Vol. 259, No. 5, pp. 427–439.) Theory is presented of transformer circuits for solving simultaneous equations and inequalities; the reduction of errors due to transformer imperfections is discussed. The practical aspects are illustrated by a problem involving checking the compatibility of ten inequalities with six variables. The present device is similar to that described by Mallock (*Proc. roy. Soc. A*, May 1933, Vol. 140, No. 841, pp. 457–483).

681.142 : 621.314.7 **3170**

A Transistor Digital Fast Multiplier with Magnetostrictive Storage.—G. B. B. Chaplin, R. E. Hayes & A. R. Owens. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 412–425.) The multiplier is operated at a basic frequency of 125 kc/s, and comprises timing-waveform generator, arithmetic unit and storage system. Except for the use of junction transistors in the amplifiers associated with the storage system, point-contact types are used throughout. Out of a total of 84 point-contact transistors, 12 junction transistors and 568 crystal diodes, three point-contact units have failed in seven months of daily operation. No selection of transistors is required. The total power consumption is 50 W.

681.142 : 621.37 **3171**

The Solution of Plane Stress Problems by an Electrical Analogue Method.—G. Liebmann. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, pp. 145–157.) "It is shown that the biharmonic equation $\nabla^4 X = 0$, which Airy's stress function has to satisfy, can be solved by an electrical analogue comprising two resistance networks in cascade."

681.142 : 621.37 **3172**

Three-Dimensional Electrical-Analogue Models for studying Drainage by Free-Surface Filtration.—P. Huard de la Marre. (*C. R. Acad. Sci., Paris*, 6th June 1955, Vol. 240, No. 23, pp. 2203–2205.)

681.142 : 621.375.4 **3173**

Transistor Amplifiers for Analog Computers.—Ettinger. (See 3210.)

681.142 : 621.387 **3174**

The Cold-Cathode Gas Diode.—(*Tech. News Bull. nat. Bur. Stand.*, May 1955, Vol. 39, No. 5, pp. 61–66.) An outline is given of technique used to improve the diode characteristics, involving aging by application of voltage pulses. Basic circuits using these diodes as computer elements for gating, storage, etc., are described.

681.142 : 642.6 **3175**

Language Translation by Electronics: Novel Application of Digital Computing Machines.—Cleave & Zacharov. (See 3383.)

CIRCUITS AND CIRCUIT ELEMENTS

621.314.2 : 621.318.423 **3176**

The Single-Layer Solenoid as an R.F. Transformer.—W. A. Edson. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 932–936.) Design curves are presented for air-cored transformers. Inductances of $0{\cdot}1\ \mu$H–10 mH, coupling coefficients of 0·001–1, and inductance ratios of 100 : 1 are covered directly.

621.316.8 : 621.315.212 **3177**

The Radio-Frequency Coaxial Resistor using a Tractorial Jacket.—C. T. Kohn. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 951–960.) Design of resistors for the reflection-free termination of coaxial lines is discussed. Using an approach based on treatment of a short length of the resistor as a conical coaxial line, the resulting profile of the jacket is a tractrix. Detailed analysis indicates that with this configuration the field satisfies the boundary conditions better than with an exponential jacket. The most important design parameter is the ratio length/diameter; for resistances $< 80\ \Omega$ values of this ratio between 8 and 20 are satisfactory. The difficulty of obtaining uniform distribution of resistance over the surface of the resistor may be a limiting factor in the accuracy of the termination.

621.316.86 **3178**

High-Value Organic-Film Resistors.—P. Bristeau. (*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 220–221.) Stable resistors of resistance 10^7–$10^{14}\ \Omega$ are prepared by coating a dispersion of e.g. colloidal carbon in gelatine on a glass support and mounting the unit in an evacuated enclosure.

621.316.86 **3179**

Production, Characteristics and Applications of Nonlinear Resistors.—N. Thien-Chi & J. Vergnolle. (*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 222–236.)

621.318.5 **3180**

A Shifting Register using Ferroresonant Flip-Flops.—S. Duinker. (*Appl. sci. Res.*, 1955, Vol. B4, No. 5, pp. 317–328.) An arrangement is described in which the information can be shifted in either direction, depending on the polarity of the shifting pulse. Consideration is given to design for operation with supply frequencies in the Mc/s range.

621.318.57 : 546.289 : 535.215 **3181**

A Two-State Light-Activated Circuit Element using Germanium.—J. W. Granville. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, pp. 172–173.) A bar of n-type germanium with a potential difference across its ends and a suitably biased point contact near the middle will show double-base-diode action. The point-contact diode will conduct, or cease to conduct, according as one end or the other of the bar is illuminated, both states being stable when the light is removed. In practice the bar is divided near the point contact and the two parts are connected by copper wire to ensure that holes generated in one section recombine before they are swept into the other.

621.37.049.75 **3182**

Etched-Foil Printed Circuits.—H. G. Manfield. (*Wireless World*, Sept. 1955, Vol. 61, No. 9, pp. 436–440.) Discussion with particular reference to photomechanical methods of production.

621.372.4 **3183**

A Theorem on the Decomposition of the Derivative of the Operational Impedance of a Two-Pole Network.—L. Lunelli. (*Alta Frequenza*, April 1955, Vol. 24, No. 2, pp. 110–138.)

621.372.412 : 621.317.3 **3184**

Dynamic Measurements on Piezoelectric Resonators with Very Strong Electromechanical Coupling.—H. E. Müser & H. Bittel. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 231–236.) The equivalent circuit used as the basis of measurements on quartz crystals is not suitable in conditions of strong electromechanical coupling such as exist in ferroelectric crystals at the Curie point. The complete equivalent circuit for longitudinal resonance in such conditions includes a number of parallel branches whose contributions to the total piezoelectric current correspond to the coefficients of a Fourier representation of the oscillation mode. Results given by the theory are compared with observations of the oscillations of a Rochelle-salt resonator.

621.372.413 **3185**

Tuning of a Rectangular Parallelepiped Cavity Resonator with a Circular Metallic Post.—J. R. Macdonald. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 433–434.) A relation is derived between the resonance frequency and small displacements of a post projecting into the resonator, using a perturbation formula due to Slater (2668 of 1947). The calculation is carried out to the first order for a rectangular cavity operating in the TE_{110} mode; the result is compared with a similar relation for a right circular cylinder whose length is varied by a plunger completely closing one end.

621.372.413 : 537.533 : 530.145 **3186**

Quantum Effects in the Interaction between Electrons and High-Frequency Fields: Part 2.—I. R. Senitzky. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 875–884.) Part 1 (369 of February) reported an analysis of the effect of the interaction on the motion of the electrons; the effect on the field in the resonant cavity is now analysed. The value of the field strength differs from the classical value by a small amount due to the wave properties of the electrons. The dispersion in the field is evaluated and the number of electrons required in a bunch to produce a field comparable to the dispersion is calculated. For typical experimental conditions the highest frequency at which this requirement can be met is of the order of 3×10^{12} c/s.

621.372.413/.414 : 621.3.047 **3187**

Collapsed Toroidal Springs as Contact Elements in Microwave Cavities.—C. L. Andrews. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 777–778.)

621.372.44 **3188**

On Extraordinary Phenomena in a Nonlinear Forced Oscillation.—A. Sakurai. (*J. phys. Soc. Japan*, April 1955, Vol. 10, No. 4, pp. 274–278.) The nonlinear forced oscillation represented by $\ddot{x} - dF(x)/dx = p \cos \omega t$ is discussed. Transforming this equation to the variational form, the Ritz method is applied to obtain the solution in the form of a Fourier series, in which extraordinary points of two different kinds are distinguished. This method is applied to find the jump voltage of a circuit containing an iron-cored reactor.

621.372.5 **3189**

Investigation of Coupled Electrical Circuits with Constant Lumped Parameters under Variable Conditions: Part 1.—E. Astuni. (*Ricerca sci.*, May 1955, Vol. 25, No. 5, pp. 1075–1094.) Analysis involving the inverse Laplace transform is presented for determining the current in the secondary circuit. Numerical examples are given.

621.372.5 : 512.83 **3190**

A Note on the Application of Determinants to the Solution of Linear Network Problems.—P. W. Seymour. (*Proc. Instn Radio Engrs Aust.*, May 1955, Vol. 16, No. 5, pp. 145–151.)

621.372.543.2 : 621.372.413 : 621.396.41.029.63 **3191**

Coaxial Cavity Filters for Multiplexing of 900-Mc/s Radio-Relay Systems.—M. H. Kebby. (*Elect. Engng, N.Y.*, May 1955, Vol. 74, No. 5, pp. 425–429.) Essentially full text of paper to be published in *Trans. Amer. Inst. elect. Engrs, Communication and Electronics*, 1955. Filters are discussed comprising cascaded $\lambda/4$ coaxial-line sections; the selectivity attained permits a frequency separation as low as 12 Mc/s between a transmitter and a receiver operating on a common aerial, and a separation as low as 6·3 Mc/s between transmitters or receivers.

621.372.543.2 : 621.375.2 **3192**

Transient Response of Band-Pass Filters.—F. Baur. (*Frequenz*, May 1955, Vol. 9, No. 5, pp. 141–146.) Analysis for multistage band-pass amplifiers with parallel-*RLC* coupling circuits is based on consideration of the characteristic values of the individual circuits.

621.372.543.2 : 621.375.4 : 621.314.7 **3193**

A Band-Pass Filter with Active Elements.—H. N. Putschi. (*Elektrotech. u. Maschinenb.*, 1st May 1955, Vol. 72, No. 9, pp. 193–197.) The design of a filter/amplifier is described in which impedance inversion and loss compensation are achieved using two *n-p-n* junction transistors Type 2N27 in an arrangement based on the valve circuit described by Harris (2678 of 1951). The centre frequency of the filter is 2·6 kc/s and the bandwidth is 20 c/s and 200 c/s at the 3-db and 40-db points respectively. A complete unit shown includes a third transistor, with grounded-emitter connection, and gives an overall gain of 20 db.

621.372.552 **3194**

Loss and Phase of Simple Equalizers.—H. J. Orchard. (*Wireless Engr*, Sept. 1955, Vol. 32, No. 9, pp. 235–238.) Approximate computations are performed using the first one or two terms of a rapidly convergent power-series expansion.

621.372.57 : 621.385 : 621.396.822 **3195**

The Noise Figure of Linear Quadripoles and Amplifier Valves.—König. (See 3435.)

621.373 : 621.316.729 **3196**

On Subharmonic Synchronization of Nearly-Linear Systems.—H. Cohen. (*Quart. appl. Math.*, April 1955, Vol. 13, No. 1, pp. 102–105.) Analysis is presented for a slightly nonlinear oscillator driven at a frequency near a multiple of its natural frequency, the system corresponding to the equation

$$\ddot{y} + \epsilon f(y)\dot{y} + \omega_0^2 y = A \cos (n\omega t + \phi)$$

where the forcing term is of the order of unity. Conditions for obtaining a response at angular frequency ω are investigated by expanding y in a series in ϵ.

621.373.4 : 621.385.029.6 : 621.396.822 **3197**

1954 Symposium on Fluctuation Phenomena in Microwave Sources.—(See 3440.)

621.373.421 **3198**

A Twin-T *RC* Oscillator.—M. J. Tucker. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 346–347.) The design of a 1-kc/s oscillator similar to that described by Francini & Zaccheroni (1345 of 1954) is briefly discussed. Performance characteristics are presented graphically. The frequency is variable over a limited range.

621.373.43 **3199**

A Triggered Timebase for Oscillographs.—W. Seefeldner. (*Z. angew. Phys.*, April 1955, Vol. 7, No. 4, pp. 194–195.) A triggered sawtooth generator is described. See also 71 of January.

621.373.43 : 621.314.7 **3200**

Transistors generate Multiwaveforms. — E. Keonjian & J. J. Suran. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 138–139.) The use of junction transistors as nonlinear network elements is illustrated by a discussion of the design of a regenerative-degenerative oscillator.

621.373.431.1 **3201**

Approximate Calculation of the Relaxation Process and Time Delay in the Multivibrator.—G. Haas. (*Z. angew. Phys.*, Sept. 1954, Vol. 6, No. 9, pp. 396–404.) Calculations are presented based on representation of the valve characteristic curves by third-degree polynomials. A delay of about 2×10^{-7} sec between the initiation of instability and the commencement of the anode pulse is found for a particular circuit using Type-EF42 pentodes.

621.373.432 : 621.387 **3202**

A New Method for generating Relaxation Oscillations with a Gas-Filled Triode.—A. Székely. (*Acta phys. austriaca*, April 1955, Vol. 9, No. 2, pp. 99–106.) Large-amplitude relaxation oscillations can be generated by applying a small h.f. voltage to the grid of a gas-filled triode in which the grid is connected to the cathode via a high resistance. The waveform of the relaxation oscillation depends on the parameters of the circuit in parallel with the anode-to-cathode path and on the excitation frequency, and the frequency of the relaxation oscillation can be varied over a wide range.

621.373.52 : 621.314.7 **3203**

A Transistor Oscillator.—M. Bichara. (*C. R. Acad. Sci., Paris*, 20th June 1955, Vol. 240, No. 25, pp. 2393–2395.) A high-stability portable oscillator uses a single point-contact transistor and a quartz-crystal resonator in a Wien-bridge circuit. The frequency variation is ± 0·0055% for supply-voltage variations of 44% or more.

621.373.52 : 621.314.7 **3204**

A Guide to the Design of Sinusoidal Oscillators using Junction Transistors.—(*Mullard tech. Commun.*, May 1955, Vol. 2, No. 12, pp. 48–55.) Oscillators based on series and parallel resonant circuits, *RC* phase-shift networks, negative-resistance effects and control crystals are included.

621.374.4 **3205**

Contribution on the Problem of Frequency Dividing.—P. Thiessen. (*Tech. Hausmitt. NordwDtsch.-Rdfunks*, 1955, Vol. 7, Nos. 3/4 & 5/6, pp. 77–87 & 101–110.) Dividing circuits for both pulse and sinusoidal signals are discussed. Details are given of a simple locked-in oscillator giving division factors up to 20, a self-starting regenerative divider, and a divider with controlled oscillator, a laboratory model of which gives division factors $> 1\,000$ in a single step. 34 references.

621.375.13 **3206**

Contribution on the Problem of Feedback.—H. Haller. (*Frequenz*, May & June 1955, Vol. 9, Nos. 5 & 6, pp. 164–172 & 188–199.) A review of methods for analysis and design of feedback amplifiers. 52 references.

621.375.221 **3207**

All-Pass Amplifier.—H. J. Woll. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 155–157.) In a five-stage amplifier for the frequency range 10–70 Mc/s, having an overall gain of 8, high-frequency attenuation is reduced by using the parasitic capacitances of the valves as elements in a high-pass filter.

621.375.221.1 **3208**

The Design of Stagger-Tuned Double-Tuned Amplifiers for Arbitrarily Large Bandwidth.—M. M. McWhorter & J. M. Pettit. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 923–931.)

621.375.3 **3209**

Asymmetry Zero-Drift Errors in Magnetic Amplifiers.—W. A. Geyger. (*Elect. Engng, N.Y.*, May 1955, Vol. 74, No. 5, p. 431.) Digest of paper to be published in *Trans. Amer. Inst. elect. Engrs, Communication and Electronics*, 1955.

621.375.4 : 681.142 **3210**

Transistor Amplifiers for Analog Computers.—G. M. Ettinger. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 119–121.) High- and low-gain transistor amplifiers for servo use are described; effects of power supply variations and temperature coefficients are shown.

621.375.4.029.3 : 621.314.7 **3211**

Temperature Compensation in a Low-Consumption Transistor Amplifier.—C. Hannigsberg. (*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 264–277.) The circuit design is developed for a two-stage amplifier for the frequency range 300–3 400 c/s giving a stable distortion-free output of 12–22 mW with an ambient temperature variable over the range 15°–50°C. By suitable choice of circuit elements compensation is obtained without increased power consumption and the amplifier characteristics may be made independent of the actual transistors used.

621.375.43 : 621.314.7 **3212**

Unilateralization of Junction-Transistor Amplifiers at High Frequencies.—G. Y. Chu. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 1001–1006.) Neutralization of the inherent internal feedback of the junction transistor is provided by applying external feedback. Practical circuits are illustrated and their performance characteristics discussed.

621.376.22 **3213**

Carrier Leak in Rectifier Modulators of the Shunt Type.—G. L. Connon. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 475–487.) 'Carrier leak' is the term used for the unbalance carrier-frequency component in the modulator output. An experimental investigation is reported of factors affecting the attainment of very low leak levels, from 40 to 80 db below carrier level, and of the possibilities of d.c. balancing of the rectifier bridge. Square-wave and sinusoidal signals are considered. The results indicate that control of carrier-leak adjustment by use of a d.c. meter is likely to be practical. The effect of carrier-generator impedance is discussed. Some details are given for a modulator with no transformer. Very low leak levels are attainable by correct relative adjustment of the two coupling capacitors.

GENERAL PHYSICS

530.112 **3214**

A New Aether-Drift Experiment.—L. Essen. (*Nature, Lond.*, 7th May 1955, Vol. 175, No. 4462, pp. 793–794.) Results of the experiment referred to previously (2618 of 1954) are reported. A cylindrical cavity resonator, used to control the frequency of an oscillator at about 9·2 Mc/s, was mounted with its axis horizontal and was rotated in a horizontal plane. The frequency of the oscillator was compared with that of a quartz standard at intervals of 45° of the rotation.

534.01 **3215**

Some Aspects of Standing-Wave Patterns.—C. P. Allen & P. A. Lindsay. (*Wireless Engr*, Sept. 1955, Vol. 32, No. 9, pp. 239–245.) General analysis is given for the production of standing waves, and three-dimensional patterns obtained by plotting the wave equations are presented for various cases.

534.012 : 537.228.1 **3216**

Specific Directions of Longitudinal Wave Propagation in Anisotropic Media.—F. E. Borgnis. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1000–1005.) Analysis relevant to piezoelectric oscillations is presented. Trigonal, hexagonal, tetragonal and cubic crystals are considered, and the directions of propagation of purely compressional waves are determined.

535.37 **3217**

Electroluminescence.—A. Fischer. (*Z. angew. Phys.*, May 1955, Vol. 7, No. 5, pp. 258–263.) A survey of existing knowledge of the physical process involved, with numerous references.

537/538].081 **3218**

Recommendations of I.E.C. [International Electrotechnical Commission] **Technical Committee 24: Electric and Magnetic Magnitudes and Units.**—J. J. Smith. (*Elect. Engng, N.Y.*, May 1955, Vol. 74, No. 5, pp. 406–408.) Full text of paper to be published also in *Trans. Amer. Inst. elect. Engrs, Communication and Electronics*, 1955. Recommendations made at the meeting in September 1954 are reported.

537.311.1 **3219**

Plasma Oscillations in Metals.—E. N. Adams. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 947–953.) The effect of the energy-band structure on the plasma frequency is analysed.

537.311.62 **3220**

Theory of Anomalous Skin Effect.—M. I. Kaganov & M. Ya. Azbel'. (*C. R. Acad. Sci. U.R.S.S.*, 1st May 1955, Vol. 102, No. 1, pp. 49–51. In Russian.) An exact expression is derived for the surface impedance for the case of arbitrary dispersion of conduction electrons (eqn 1), assuming an infinitely long mean free path. The conclusions are: (*a*) the dependence of the impedance Z on the angle between the normal to the surface and the crystallographic axes is determined by tensor B_{ik}; (*b*) the frequency dependence of the impedance, $\omega^{2/3}$, and the relation between the real and imaginary parts of Z are independent of the form of the dispersion relation; (*c*) the derivation of equation (11) for $Z_{x,y}$ is independent of the interaction of electrons with the lattice and hence may be used in the determination of the Fermi surface.

537.5 **3221**

Influence of Inhomogeneity of a Plasma on its Resonance Frequency.—A. Esprester & A. Haug. (*Z. angew. Phys.*, April 1955, Vol. 7, No. 4, pp. 180–183.) Nonuniformity of the electron concentration in the plasma may give rise to variations of 50%–100% in the resonance frequency. This explains some discrepancies between the Langmuir relation and experimental results. The effect of damping is, however, negligible, as are also magnetic effects.

537.5 **3222**

High-Frequency Ionization Coefficients in Neon-Argon Mixtures.—A. D. MacDonald & J. H. Matthews. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1070–1073.)

537.52 **3223**

Electrical Breakdown of Air at Small and Medium Overvoltages.—W. Köhrmann. (*Z. angew. Phys.*, April 1955, Vol. 7, No. 4, pp. 187–194.) Experimental results indicate that at values of pressure × distance about 1 000 Torr. cm, breakdown due to overvoltages of 0·1 to 20% is produced by a Townsend ionization mechanism rather than by the electron-avalanche build-up of a channel as described by Raether (*Z. Phys.*, 30th April 1939, Vol. 112, Nos. 7/8, pp. 464–489). At overvoltages > 30% the latter process is operative.

537.525 **3224**

Electrical Breakdown in High Vacuum.—W. S. Boyle, P. Kisliuk & L. H. Germer. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 720–725.) Report of an investigation using gaps shorter than 0·0008 cm between tungsten electrodes. In most cases of breakdown, field-emission currents from small irregularities on the cathode cause evaporation of metal from the anode, the breakdown occurring in the resulting vapour.

537.525 : 621.396.822 **3225**

Noise from Hot-Cathode Discharges.—Thong Saw Pak. (*Proc. phys. Soc.*, 1st May 1955, Vol. 68, No. 425B, pp. 292–296.) Experiments with mercury-vapour tubes, in which anode-glow disturbances were eliminated, show that low-frequency noise in an unsaturated discharge is due to a coherent random fluctuation of the whole plasma, probably caused by fluctuations of the cathode sheath. Under certain conditions another effect was distinguished which may be due to fluctuations of sheaths on the probes used, or on the tube walls.

537.533 **3226**

Work Function of Tungsten Single-Crystal Planes measured by the Field-Emission Microscope.—E. W. Müller. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 732–737.)

537.533/.534 : 530.145.6 **3227**

Wave-Mechanics Treatment of Electron and Ion Beams with Curved Axis.—H. Grümm. (*Optik, Stuttgart*, 1955, Vol. 12, No. 4, pp. 153–165.)

537.581 : 548.0 : 546.78 **3228**

Velocity Analysis of Thermionic Emission from Single-Crystal Tungsten.—A. R. Hutson. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 889–901.) The energy distribution of electrons emitted in various directions from the W filament was analysed using a special tube in which the electron trajectories were bent by a magnetic field. The observed distributions were the same for all directions and were not Maxwellian. Variations of true work function over the temperature range 1 700°–2 000°K were measured for several crystallographic directions. The results are discussed in relation to values of the Richardson emission constant found by other workers.

538.1 **3229**

Possibility of defining a Scalar Magnetic Potential inside Currents, and Application to the Design of Magnetic Electron Lenses.—É. Durand. (*C. R. Acad. Sci., Paris*, 20th June 1955, Vol. 240, No. 25, pp. 2390–2393.) The system considered is a thick solenoid; various equivalent magnetic-shell systems and the corresponding magnetic-potential distributions are discussed.

538.3 **3230**

Electromagnetic Theory of Moving Matter: Part 1.—E. J. Post. (*Tijdschr. .ned. Radiogenoot.*, March 1955, Vol. 20, No. 2, pp. 93–102. In English.) Conceptual difficulties arising in connection with the didactical presentations of classical theory are discussed, using an alternative approach to that of Hammond (97 of January).

538.3 **3231**

The Angular Momentum of the Electromagnetic Field.—N. Carrara, T. Fazzini, L. Ronchi & G. Toraldo di Francia. (*Alta Frequenza*, April 1955, Vol. 24, No. 2, pp. 100–109.)

538.3 **3232**

Observations on an Energy Relation in Magnetohydrodynamics.—R. Nardini. (*R. C. Accad. naz. Lincei*, April 1955, Vol. 18, No. 4, pp. 376–377.)

538.566 + 534.2 **3233**

Correlation of Amplitude and Phase Fluctuations in Wave Propagation in a Medium with Random Inhomogeneities.—L. A. Chernov. (*Akust. Zh.*, Jan./March 1955, Vol. 1, No. 1, pp. 89–95.) The two problems noted in 989 of April are treated more fully. The value of the correlation coefficient R_{as} between amplitude and phase fluctuations at the receiving point $(L, 0, 0)$ is given by equation 23 and reduces to $\sim 0{\cdot}6$ for small distances and to $\ln D/D$ for large distances, where $D \gg 1$. D is given by $4L/ka^2$, where $k = \omega_0/c_0$ and a is the dimension of the inhomogeneities. The autocorrelation coefficient for amplitude fluctuations at points $(L, 0, 0)$ and $(L, 0, l)$ is plotted as a function of l/a in curve 1, that of phase fluctuations in curve 3; the curves refer to the case when $D = 10$ and ka lies between 10^2 and 10^4.

538.566 **3234**

Theoretical and Experimental Study of Electromagnetic Scattering by Two Identical Conducting Cylinders.—R. V. Row. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 666–675.) "The scattering of a cylindrical TEM wave by two parallel, identical conducting circular cylinders is developed as a special case of a theoretical analysis which treats the scattering by an arbitrary array of cylinders. Only the case with the incident E-vector parallel to the axes of the cylinders is considered, and attention is focused on the mutual effects present when the cylinder diameter and spacing are comparable to a wavelength. The approximations made in the theory are tested experimentally using 3-cm microwaves in a parallel plate region. Significant departures from the results of the independent scattering hypothesis as predicted by the theory have been confirmed experimentally."

538.566 : 535.42 **3235**

Diffraction of Electromagnetic Waves by Circular Plate and Circular Hole.—Y. Nomura & S. Katsura. (*J. phys. Soc. Japan*, April 1955, Vol. 10, No. 4, pp. 285–304.) Rigorous analysis is presented, using the method of expansion by the hypergeometric polynomial. Total scattering cross-section, transmission coefficient, current in the disk, field in the hole, and field at a distant point are shown graphically as functions of ka, where $k = 2\pi/\lambda$ and a is the radius.

538.566 : 535.42 **3236**

Microwave Diffraction by Apertures of Various Shapes.—S. J. Buchsbaum, A. R. Milne, D. C. Hogg, G. Bekefi & G. A. Woonton. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 706–715.) Results of an experimental investigation of the near-zone diffraction field of circular, elliptical and slit apertures are presented. In general, these results are consistent with theory presented previously [e.g. 709 of 1954 (Bekefi)].

538.566 + 534.2] : 535.43 **3237**

The Scattering of a Scalar Wave by a Semi-infinite Rod of Circular Cross Section.—D. S. Jones. (*Phil. Trans. A*, 19th April 1955, Vol. 247, No. 934, pp. 499–528.) Analysis indicates that for a wave incident along the axis of the rod, and assuming zero variation of field with distance at the end surface, corresponding to the case of sound waves incident on a rigid rod, the scattering coefficient is $\frac{1}{4}(ka)^2$, for $ka < 2$, where k is the wave number and a is the radius of the rod. Graphs show the variation of the average pressure amplitude on the end of the rod, and of the scattering coefficient, over the range $0 \leqslant ka \leqslant 10$. The average pressure amplitude on the end of the rod for other angles of incidence is calculated. An expression is derived for the scattered field when the field at the surface is zero, corresponding to the case of an aerial when only the component of the electric field parallel to the axis of the rod is considered.

538.566 : 535.43 **3238**

Scattering of a Plane Wave from a Circular Dielectric Cylinder at Oblique Incidence.—J. R. Wait. (*Canad. J. Phys.*, May 1955, Vol. 33, No. 5, pp. 189–195.) Analysis is presented for the general case. The solution indicates that the scattering field includes a significant cross-polarization component which vanishes at normal incidence. The results are applicable to scattering by ionized columns such as meteor trails.

538.566 : 535.51 **3239**

Polarization of Electromagnetic Waves.—F. I. Fedorov. (*C. R. Acad. Sci. U.R.S.S.*, 1st May 1955, Vol. 102, No. 1, pp. 69–71. In Russian.) Basic relations of polarized e.m. waves are expressed in vector notation. Use is made of the vector of refraction, $\mathbf{m}$, defined as the product of the refractive index and the real unit-vector of the wave normal.

538.566 : 538.221 **3240**

Nonlinearity of Propagation in Ferrite Media.—N. G. Sakiotis, H. N. Chait & M. L. Kales. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, p. 1011.) Measurements are reported emphasizing the need to take account of nonlinearity effects when designing microwave ferrite devices for use at high peak power levels. The results are applicable for conditions remote from gyromagnetic resonance.

538.6 : 539.15 **3241**

Magnetic Resonance for Arbitrary Field Strengths.—R. K. Wangsness. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 927–933.) Discussion is presented for a paramagnetic gas, assuming that strong collisions are the only important factor apart from the applied magnetic field, and that the latter comprises a circularly polarized component in the plane perpendicular to the constant components.

539.15 : 548.0 **3242**

Interpolation Scheme for Energy Bands in Solids.—L. C. Allen. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 993–996.)

621.3.032.44 **3243**

The Distribution of Temperature along a Thin Rod Electrically Heated in Vacuo: Part 6—End-Losses.—S. C. Jain & K. S. Krishnan. (*Proc. roy. Soc. A*, 24th May 1955, Vol. 229, No. 1179, pp. 439–445.) The correction for end losses is calculated for some typical physical properties which are functions of powers of temperature T, $\exp(1/T)$, or both (as in thermionic emission). The calculated corrections for a long W filament agree closely with those computed graphically by Worthing (*J. Franklin Inst.*, Nov. 1922, Vol. 194, No. 5, pp. 597–611). The corrections for medium-length filaments such as used in h.f. power valves are practically the same as those for a long filament heated by the same current. Part 5: 1963 of July.

621.396.822.029.6 **3244**

Electrodynamical Theory of Thermal Radiation.—M. L. Levin. (*C. R. Acad. Sci. U.R.S.S.*, 1st May 1955, Vol. 102, No. 1, pp. 53–56. In Russian.) A theoretical note on thermal electrical fluctuations; phenomena in cavity resonators and waveguides are considered.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.16 **3245**

Radio-Astronomy.—R. L. Smith-Rose. (*Wireless Engr*, Sept. 1955, Vol. 32, No. 9, pp. 227–229.) A brief survey of techniques, results and applications.

523.16 **3246**

A Radio Survey of the Great Loop in Cygnus.—D. Walsh & R. H. Brown. (*Nature, Lond.*, 7th May 1955, Vol. 175, No. 4462, pp. 808–809.) Some details are given of a radio source discovered as a result of a survey made at Jodrell Bank at a frequency of 92·5 Mc/s.

523.16 : 621.396.677.3 **3247**

New Modulation System of Radio Reception of Weak Signals and its Application in the Design of a Radiotelescope of Extremely High Resolving Power.—V. V. Vitkevich. (*C. R. Acad. Sci. U.R.S.S.*, 21st May 1955, Vol. 102, No. 3, pp. 469–472. In Russian.) Features of the systems described by Vitkevich (2658 of 1954) and Mills & Little (see e.g. 633 of 1954) were combined to give a high resolution; a swinging aerial beam is obtained by varying the electrical lengths of the feeders. The system is explained with the aid of a block diagram.

523.72 : 621.396.822 : 551.510.535 **3248**

A Solar Noise Outburst of January 15, 1955.—T. R. Hartz. (*Nature, Lond.*, 21st May 1955, Vol. 175, No. 4464, pp. 908–909.) Outbursts of noise were observed at Ottawa with an interferometer-type receiver, at a frequency of 50 Mc/s, on 15th, 16th, 18th and 19th January 1955. A study of the vertical-incidence ionosphere records indicates that storm conditions, with spread F_2 echoes, low values of f_0 F_2, increased absorption, E_s and blackout, followed the outbursts. Auroral displays were reported from parts of Canada and the U.S. during the period.

523.78 : 621.396.81.029.55 **3249**

Change of Radio Signal Strength during Solar Eclipse 30th June 1954.—Karnov. (See 3395.)

538.71 : 621.317.444 **3250**

A Simple, Sensitive, Saturated-Core Recording Magnetometer.—Gerard. (See 3356.)

551.510.534 **3251**

The Vertical Distribution of Atmospheric Ozone determined by Balloon Ascents.—H. K. Paetzold. (*Z. Naturf.*, Jan. 1955, Vol. 10a, No. 1, pp. 33–41.) Measurements made with an automatically recording ultraviolet spectrograph are reported.

551.510.535 **3252**

D-Layer Ionospheric Echoes at Macquarie Island.—G. Major. (*Nature, Lond.*, 14th May 1955, Vol. 175, No. 4463, pp. 862–863.) Echoes from D-layer heights have been recorded at the Australian station on Macquarie Island (54°30′S, 158°57′E; geomagnetic latitude −61·7°) since operation started in 1950. Echoes are of similar type to those observed in tropical latitudes and occur on most days of the year. On a few occasions each month echoes persist throughout the night. The highest frequency at which echoes are received usually increases from below 2 Mc/s at first appearance (within an hour after ground sunrise) to above 7·5 Mc/s at noon, decreasing to below 2 Mc/s at disappearance (during the hour before sunset). Strong D echoes remain on occasions when other daytime echoes are absent due to high absorption. The effect may be peculiar to island observatories.

551.510.535 **3253**

The Effect of Vertical Ion Transport on the Night-Time E Region.—H. R. Peiffer & A. P. Mitra. (*J. atmos. terr. Phys.*, June 1955, Vol. 6, No. 6, pp. 291–303.) Anomalous behaviour of the night-time E layer and the formation of the night-time sporadic E layer may be explained by vertical ion drifts, not necessarily tidal.

551.510.535 **3254**

On Anomalous Variations of Maximum Electron Density and its Height in the F_2 Region of the Ionosphere.—T. Sato. (*J. Geomag. Geoelect.*, Sept. 1954, Vol. 6, No. 3, pp. 99–119.) An examination of world-wide observations during periods of sunspot maximum and minimum suggests that anomalous behaviour of the F_2 region is mainly controlled in low and middle latitudes by geomagnetic factors and in higher latitudes by geographic factors. The fall in the level corresponding to maximum electron concentration over the magnetic equator may be accounted for by vertical electron drifts, whose magnitudes are deduced; seasonal anomalies in f_0F_2 may be explained by variations in the height distribution of the particles from which the ions in the region are produced.

551.510.535 **3255**

On Latitudinal Distributions of Diurnal and Semi-diurnal Components of $h'F_2$ of the Ionosphere.—T. Sato & T. Namikawa. (*J. Geomag. Geoelect.*, Sept. 1954, Vol. 6, No. 3, pp. 157–159.) Results of an analysis of world-wide observations of $h'F_2$ for December 1945 and June 1946 are given in a series of histograms.

551.510.535 : 523.72 **3256**

On the Solar Lyman Beta Radiation and the Ionosphere.—S. Kato. (*J. Geomag. Geoelect.*, Sept. 1954, Vol. 6, No. 3, pp. 153–156.) Solar Lyman β radiation will be absorbed by atomic oxygen in the ionosphere with emission of α' radiation. Observation of such radiation originating in the F_2 region would be a criterion for the validity of the ionospheric model.

551.510.535 : 550.38 **3257**

Geomagnetic Distortion of the F_2 Region on the Magnetic Equator.—M. Hirono & H. Maeda. (*J. Geomag. Geoelect.*, Sept. 1954, Vol. 6, No. 3, pp. 127–144.) Calculations based on an atmospheric model inferred from rocket observations and using the dynamo theory of the earth's magnetic field show that the diurnal variation of the vertical electron drift, due to the e.s. field, is sufficient to account for the observed distortion of the F_2 region over the magnetic equator; the presence of the F_1 layer is also accounted for. Changes following the sunspot cycle may be caused by a slight shift of the phase of the drift.

551.510.535 : 550.385 **3258**

Studies on the Disturbances in F_2 Layer associated with Geomagnetic Disturbances.—K. Sinno. (*J. Geomag. Geoelect.*, Sept. 1954, Vol. 6, No. 3, pp. 120–126.) F_2-layer disturbances associated with geomagnetic storms consist of two components, $S_D(f_0F_2)$, which is effective only in the earlier stage and is dependent on longitude, and $D_{st}(f_0F_2)$, which begins simultaneously with the storm and gradually grows to large amplitude 8–10 hours later. Variations with latitude and season are plotted from world-wide data for the period 1949–1951. The disturbances follow the trend of geomagnetic activity, except for $D_{st}(f_0F_2)$ in winter. The effect of sunspot activity is shown.

551.510.535 : 551.55 : 523.5 : 621.396.96 **3259**

Diurnal and Seasonal Wind Variations in the Upper Atmosphere.—J. S. Greenhow & E. L. Neufeld. (*Phil. Mag.*, May 1955, Vol. 46, No. 376, pp. 549–562.) Results are presented graphically of observations of winds at altitudes of 80–100 km, made at Jodrell Bank between September 1953 and November 1954. The measurements were based on radio reflections from meteor trails [3218 of 1954 (Greenhow)]. Four distinct wind components were distinguished: (*a*) with semi-diurnal periodicity, of amplitude 10–40 m/s rotating clockwise; (*b*) with diurnal periodicity, of 5–10 m/s; (*c*) prevailing winds of 5–25 m/s, towards the east in summer and winter and towards the west in spring and autumn; (*d*) turbulent winds of the order of 30 m/s with occasional wind shears of 50 m/s over height differences of a few kilometres.

551.594.221 **3260**

Electrostatic Field-Changes Due to Lightning Discharges.—E. T. Pierce. (*Quart. J. R. met. Soc.*, April 1955, Vol. 81, No. 348, pp. 211–228.) Report and analysis of extensive observations at distances < 100 km; in this range e.s. effects are dominant over induction and radiation effects.

551.594.221 **3261**

The Development of Lightning Discharges.—E. T. Pierce. (*Quart. J.R. met. Soc.*, April 1955, Vol. 81, No. 348, pp. 229–240.) The observations reported in 3260 above are discussed and theories are advanced regarding the nature of lightning processes.

551.594.5 **3262**

The Location and Shape of the Auroral Zone.—J. H. Meek. (*J. atmos. terr. Phys.*, June 1955, Vol. 6, No. 6, pp. 313–321.) Observed characteristics of aurorae and examination of data for the Polar Year 1932–1933 support the view that an electrically neutral particle stream coming from the sun is resolved into positive and negative components on encountering the earth's magnetic field, the two components following opposing spiral tracks into the auroral zone.

551.594.6 **3263**

Noise Power Radiated by Tropical Thunderstorms.—S. V. Chandrashekhar Aiya. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 966–974.) Lightning discharge phenomena are reviewed and an expression is derived for the average electric field due to a stroke; the power at the source, corresponding to the noise field strength, measurements of which were reported previously (257 of January), is hence evaluated. Over the frequency range 1–20 Mc/s the noise power varies as f^{-2}. Discharges within the cloud or into the air are the main noise sources.

LOCATION AND AIDS TO NAVIGATION

621.396.93 **3264**

Sources of Error in U-Adcock High-Frequency Direction-Finding.—K. C. Bowen. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 529–532. Discussion, pp. 550–554.) "Statistical methods have been used to calculate the respective contributions to the total variance of error in a series of typical check bearings on known transmitters. The variance component, normally attributed to wave-interference errors, has been studied particularly, and the contributions from observational error and the effect of ground resistivity variations over the d.f. site have been estimated."

621.396.93 **3265**

On the Rapidity of Fluctuations in Continuous-Wave Radio Bearings at High Frequencies.—W. C. Bain. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 541–543. Discussion, pp. 550–554.) Bearing observations were made with an Adcock direction finder on distant transmitters at a rate of 5/sec. The autocorrelation function of the observations was calculated; it is best represented by an exponential formula with index $-\tau/\tau_0$, where the mean value of τ_0 is 0·75 sec with a standard deviation of 0·51 sec. Expressions are given for the reduction in the variance of bearing error to be obtained by time-averaging.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **3266**

Desorption of Gas in the Cold-Cathode Ionization Gauge.—E. Brown & J. H. Leck. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, pp. 161–164.) Positive ions having an energy of the order of 1 000 eV, on striking the cathode cause the liberation of gas molecules previously adsorbed on the surface during normal running of the tube, and are themselves retained, probably by a physical rather than a chemical process. There is evidence that gas is also absorbed in the interior of the electrode; this is unaffected by ionic bombardment.

531.788.7 **3267**

Response of Ionization Gauge in the Presence of Water Vapour.—R. Barre, G. Mongodin & E. Prevot. (*Le Vide*, May/June 1955, Vol. 10, No. 57, pp. 78–79.) Brief report of an experiment indicating that the sensitivity of the gauge is nearly the same for water vapour as for air.

533.5 **3268**

The Physical Processes in Diffusion and Vapour-Jet Pumps.—(*Z. angew. Phys.*, May 1955, Vol. 7, No. 5, pp. 218–240.) Comprises the following parts:—

Part 1—The Flow Properties of the Driving Jet and the Fore-Vacuum Pressure (pp. 218–225).—H. G. Nöller.

Part 2—The Mixing of Air and Jet Vapour and the Suction Rate (pp. 225–229).—H. G. Nöller.

Part 3—Comparison of Observed and Theoretically Determined Flow Patterns (pp. 229–234).—H. Kutscher.

Part 4—A Method for Measurement of the Pressure in Supersonic Vapour Streams at Low Pressure, Measurement Results, and Comparison with the Flow Patterns (pp. 234–240).—H. Kutscher.

533.5 **3269**

Ionic Pumping Mechanism of Helium in an Ionization Gauge.—L. J. Varnerin, Jr, & J. H. Carmichael. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 782–783.) It is suggested that not the glass wall itself [1050 of April (Bloomer & Haine)] but a metal film deposited on it during vacuum processing is responsible for the ionic clean-up.

535.215 : 546.482.21 **3270**

Complex Structure of the Fundamental Absorption Edge of a CdS Crystal.—E. F. Gross & M. A. Yakobson. (*C. R. Acad. Sci. U.R.S.S.*, 21st May 1955, Vol. 102, No. 3, pp. 485–488. In Russian.) About 20 closely spaced absorption lines were observed near 4800 Å λ; their presence indicates the existence of discrete electron levels in a band of about 0·05 eV in the forbidden zone. As compared with Cu_2O, the phenomena in CdS are complicated by the presence of double refraction.

535.215 : 546.817.221 **3271**

Directional Variation of Photoeffect in PbS Films.—G. Schwabe. (*Z. Naturf.*, Jan. 1955, Vol. 10a, No. 1, p. 78.) Measurements indicate a continuous variation of the photo-e.m.f. generated by PbS films as the direction of illumination is varied; the sign of the photo-e.m.f. reverses as the angle of incidence passes through a value near zero. By previously roughening the base supporting the film, larger photovoltages are developed, up to 2 V with a film area 10 mm × 25 mm. The displacement of the reversal point from zero angle of incidence is due to a nonreversing component generated at inter-crystal *p-n* contacts. This was seen clearly with films formed in a temperature gradient.

535.37 **3272**

Luminescence.—(*Brit. J. appl. Phys.*, 1955, Vol. 6, Supplement No. 4, pp. S1–S120.) The text is given of 23 papers presented at a conference held in Cambridge, England, in April 1954. Discussion and indexes are included. The emphasis was on solid inorganic phosphors.

535.37 **3273**

Apparatus for the Measurement of the Lifetime of Phosphorescence Phenomena.—A. van Roggen & R. A. Vroom. (*J. sci. Instrum.*, May 1955, Vol. 32, No. 5, pp. 180–183.) The phosphorescent light is detected photoelectrically and its intensity is compared with the output from a continuously adjustable exponential generator using a c.r.o. method with electronic switching. A relative accuracy within 2·5% has been obtained. Mixtures of two phosphors can be assessed by comparison with the sum of two independently generated exponential functions.

535.37 + 535.215] : 537.311.33 **3274**

Model for Luminescence and Photoconductivity in the Sulfides.—J. Lambe & C. C. Klick. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 909–914.) Sulphides activated by monovalent metals are considered and a model is developed according to which luminescence results from the trapping of holes rather than electrons. Such a model facilitates explanation of the different decay times for luminescence and photoconductivity. Experimental results on CdS(Ag) support the theory.

535.37 + 535.215] : 537.311.33 : 546.482.21 **3275**

Recombination Processes in Cadmium Sulfide.—J. Lambe. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 985–992.) The photoconductive spectral response and the relation between luminescence and photoconductivity were investigated experimentally. See also 3274 above.

535.37 : [546.472.21 + 546.482.21 **3276**

Magnetic Properties of Zinc Sulfide and Cadmium Sulfide Phosphors.—S. Larach & J. Turkevich. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1015–1019.) Report of magnetic-susceptibility measurements made to determine the influence of crystalline state, type and content of impurities, methods of preparation, and neutron bombardment.

535.37 : 546.482.21 **3277**

Low-Temperature Luminescence and Absorption of CdS.—L. R. Furlong & C. F. Ravilious. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 954–955.) Observations indicate that emission lines in the range 4 850–5 020 Å are due to a combined system of gas adsorbed on the CdS crystals.

535.376 **3278**

Observation of Electroluminescence excited by D.C. Fields in Cathode-Ray Tubes.—F. H. Nicoll & B. Kazan. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, p. 1012.) A brief note.

535.376 : 537.226 **3279**

Effect of Resonance Conditions on Electroluminescent Capacitors.—A. Luyckx. (*C. R. Acad. Sci., Paris*, 6th June 1955, Vol. 240, No. 23, pp. 2219–2221.) Measurements were made using a circuit including an electroluminescent capacitor with dielectric comprising a mixture of insulators of different permittivities, in series with a variable inductance. Maxima of the luminescence and current occur for nearly the same value of inductance. The effect is useful both for increasing the luminescence and for studying variations of the electrical constants of the capacitor at high voltages.

537.226/.227 : 546.33.882.5 **3280**

The Optical and Electrical Properties of Single Crystals of Sodium Niobate.—L. E. Cross & B. J. Nicholson. (*Phil. Mag.*, May 1955, Vol. 46, No. 376, pp. 453–466.) "The optical strains and dielectric constants of small single crystals of sodium niobate have been measured over the temperature range −190°C to +650°C. At room temperature the properties are consistent with an antiferroelectric structure, and for high fields applied perpendicular to the orthorhombic *c* axis, double hysteresis curves have been observed. At low temperature there is evidence of ferroelectric properties for fields applied parallel to the *c* axis. In the most perfect crystals the Curie temperature is below −209°C, but the ferroelectric phase may be induced by a high electric field. There is a long thermal hysteresis on this change and once transformed the crystals remain ferroelectric to −55°C."

537.226/.227 : 546.41/.431].824-31 **3281**

Phase Equilibria in the System $BaTiO_3$-$CaTiO_3$.—R. C. DeVries & R. Roy. (*J. Amer. ceram. Soc.*, 1st April 1955, Vol. 38, No. 4, pp. 142–146.) Investigations were made over the range from room temperature to 1 900°C, using quenching, thermal-analysis and pellet-melting techniques. The temperature of the cubic-hexagonal inversion in $BaTiO_3$ rises rapidly with additions of $CaTiO_3$ while that of the tetragonal-cubic inversion falls slightly. Solid solutions with a wide range of compositions can be used satisfactorily for growing cubic $BaTiO_3$ crystals.

537.226/.227 : 546.431.824-31 **3282**

Dielectric Behavior of Barium Titanate in the Paraelectric State.—M. E. Drougard, R. Landauer & D. R. Young. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1010–1014.) The validity of theory developed by

Devonshire (663 of 1950) was verified by making measurements over the temperature range 120°–150°C. Polarization was produced by applying a strong a.f. field and dielectric constant was measured using a weak r.f. signal. The significance of the particular experimental conditions for the results is indicated.

537.226/.227 : 546.431.824-31 **3283**

Depolarization Effects in Polycrystalline $BaTiO_3$.—H. Kniepkamp & W. Heywang. (*Z. angew. Phys.*, Sept. 1954, Vol. 6, No. 9, pp. 385–390.) Experimental results indicate that over the ferroelectric range the dielectric properties of $BaTiO_3$ depend on the size of the crystallites; the mean dielectric constant over the temperature range below the Curie point is about 1 400 for coarse-grain and about 3 000 for fine-grain material. This is explained in terms of electric and elastic depolarization effects arising from the increase of the internal surface energy.

537.226/.227 : 546.431.824-31 : 539.234 **3284**

Formation of Thin Films of $BaTiO_3$ by Evaporation.—C. Feldman. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 463–466.) Ferroelectric films about 1–2 μ thick and with dielectric properties similar to those of the bulk material have been formed on Pt substrates.

537.226/.227 : 546.48.882.5 **3285**

Dielectric, X-Ray, and Optical Study of Ferroelectric $Cd_2Nb_2O_7$ and Related Compounds.—F. Jona, G. Shirane & R. Pepinsky. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 903–909.) An investigation of the phenomena associated with the passage through the Curie point, at about 185°K.

537.226.2 + 537.311.3 **3286**

The Electrical Conductivity and Permittivity of Mixtures, with Special Reference to Emulsions of Water in Fuel Oil.—C. A. R. Pearce. (*Brit. J. Appl. Phys.*, April 1955, Vol. 6, No. 4, pp. 113–120.) The characteristics of these emulsions have been studied both directly, and indirectly by means of an electrolytic analogue. Apart from confirming early theoretical work of Wiener, results indicate that the change from a formal arrangement to a random distribution of the dispersed bodies may produce a major change in the relation between the properties of the component phases and those of the mixture; particle-size distribution may also be important.

537.226.2 **3287**

Temperature Dependence of the Dielectric Constant of Diamond.—P. T. Narasimhan. (*Proc. phys. Soc.*, 1st May 1955, Vol. 68, No. 425B, pp. 315–318.) Measurements made over the range 50–200°C give a value for $\epsilon^{-1}d\epsilon/dT$ of $+1 \times 10^{-5}$, in agreement with theory.

537.227 : 546.431.824-31 **3288**

Dynamic Behaviour of Domain Walls in Barium Titanate.—E. A. Little. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 978–984.) Kinematographic technique was used to study domain nucleation and subsequent wall movements in $BaTiO_3$ single crystals, resulting from application of direct, alternating or pulse voltages up to 500 V. Photographs and diagrams illustrate the processes observed.

537.228.1 **3289**

Piezoelectric Effect in Natural Minerals.—M. P. Volarovich & E. I. Parkhomenko. (*Bull. Acad. Sci. U.R.S.S., sér. géophys.*, May/June 1955, No. 3, pp. 215–222. In Russian.) See 1376 of May.

537.311.3 : 539.23 **3290**

The Resistivity of Thin Metallic Films.—D. E. Clark. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, pp. 158–160.) The resistivity of Bi films measured at frequencies of 0·92 × 10^{10} c/s and 2·65 × 10^{10} c/s is about 0·8 times the d.c. resistivity; for Sb no systematic difference is found.

537.311.3 : 539.23 : 621.396.822 **3291**

Experimental Results and Tentative Interpretation relative to the Flicker Effect in Granular Metal Films.—N. Nifontoff. (*C. R. Acad. Sci., Paris*, 1st June 1955, Vol. 240, No. 22, pp. 2128–2130.) Variations of resistance and flicker effect of evaporated Ag films as a function of the d.c. carried are examined. The results are interpreted in the light of previous work (e.g. 2695 of 1954).

537.311.31 **3292**

Electrical Resistivity and Plastic Deformation of Metals.—H. G. van Bueren. (*Z. Metallkde*, April 1955, Vol. 46, No. 4, pp. 272–282.) A comprehensive investigation with particular reference to experimental results obtained on Cu. Resistance increase is traced to the introduction of lattice imperfections by the deformation. See also 2640 of September (van Bueren & Jongenburger).

537.311.33 **3293**

On the Resistivity and Crystal Structure of Binary Oxide of Nickel and Cobalt.—T. Sakata, K. Sakata & K. Kigoshi. (*J. phys. Soc. Japan*, March 1955, Vol. 10, No. 3, pp. 179–186.) An experimental investigation of mixed oxides used in thermistors.

537.311.33 **3294**

Structure of Ternary Systems of Metals of Groups III and V of the Periodic System.—W. Köster & B. Thoma. (*Z. Metallkde*, April 1955, Vol. 46, No. 4, pp. 293–297.) The systems investigated are AlGaSb, AlInSb, GaInSb and AlSb-GaSb-InSb.

537.311.33 **3295**

Structure of the Systems Gallium-Antimony, Gallium-Arsenic and Aluminium-Arsenic.—W. Köster & B. Thoma. (*Z. Metallkde*, April 1955, Vol. 46, No. 4, pp. 291–293.) The phase diagrams of these binary semiconductor compounds are constructed from results of thermal analysis and microscope examination.

537.311.33 **3296**

Carrier-Concentration Disturbances in Semiconductors.—G. G. E. Low. (*Proc. phys. Soc.*, 1st May 1955, Vol. 68, No. 425B, pp. 310–314.) Four types of disturbance are distinguished: injection, exclusion, extraction and accumulation. Their occurrence in semiconducting filaments is discussed by reference to the composition of the current at the end contacts, on the assumption that the concentration variations are much smaller than the equilibrium concentration of majority carriers.

537.311.33 **3297**

Auger Effect in Semiconductors.—L. Pincherle. (*Proc. phys. Soc.*, 1st May 1955, Vol. 68, No. 425B, pp. 319–320.) The lifetime of minority carriers in semiconductors where recombination takes place at deep traps is calculated on the basis that Auger transitions alone occur. On substituting most probable values for the constants involved, a numerical result is obtained which is in satisfactory agreement with experimental results for Si obtained by Hornbeck & Haynes (2013 of July).

537.311.33 **3298**

The Theoretical Temperature Coefficient of Semiconductors.—E. Groschwitz. (*Z. angew. Phys.*, May 1955, Vol. 7, No. 5, pp. 245–249.) The temperature variation of the resistivity of semiconductors and *p-n* junctions is investigated. The temperature coefficient for an electronic semiconductor is derived as a closed expression for the whole temperature range including impurity and intrinsic conduction; the impurity concentration is assumed to be sufficiently low to neglect scattering by impurity atoms. On expanding the derived expression as a series, the known formulae for the impurity and intrinsic states are obtained as limiting cases, giving a positive coefficient for the impurity state and a negative coefficient for the intrinsic state. The temperature of the transition from impurity to intrinsic conduction is the higher the greater the impurity concentration. For *p-n* junctions the coefficient includes a small additional term depending on minority-carrier lifetime. This can sometimes be used to reduce the overall value of the coefficient, especially for symmetrical junctions.

537.311.33 **3299**

Adsorption and Surface Potential of Semiconductors: Part 1—Photo-enhanced Adsorption of Oxygen and Change of Contact Potential of ZnS Phosphors with Illumination.—A. Kobayashi & S. Kawaji. (*J. phys. Soc. Japan*, April 1955, Vol. 10, No. 4, pp. 270–273.)

537.311.33 : 537.2 **3300**

Calculation of the Space Charge, Electric Field, and Free-Carrier Concentration at the Surface of a Semiconductor.—R. H. Kingston & S. F. Neustadter. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 718–720.) The calculation is based on a solution of Poisson's equation, using Boltzmann statistics, and the results are expressed as a function of the deviations of the Fermi energy from its intrinsic value in the bulk and at the surface. Numerical values are given for Ge and Si.

537.311.33 : 546.23 **3301**

The Structure of Amorphous Selenium.—H. Grimminger, H. Grüninger & H. Richter. (*Naturwissenschaften*, May 1955, Vol. 42, No. 9, p. 256.) Two different structures are distinguished crystallographically: (*a*) folded Se_6 ring, and (*b*) expanded Se lattice [1077 of 1954 (Richter et al.)]. The former is common in specimens prepared at liquid-air temperatures, the latter in those prepared at room temperatures.

537.311.33 : 546.28 **3302**

Seebeck Effect in Silicon.—T. H. Geballe & G. W. Hull. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 940–947.) Measurements over a range of temperatures indicate large values of Seebeck voltage. Below 100°K the effect depends on charge-carrier concentration and on specimen dimensions. A low-temperature reversal of the sign of the voltage, observed for large carrier concentrations, is explained in terms of impurity-band conduction.

537.311.33 : 546.28 **3303**

Theory of Donor States in Silicon.—W. Kohn & J. M. Luttinger. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 915–922.) "By using the recently measured effective masses for *n*-type Si, $m_1 = 0{\cdot}98\ m$ and $m_2 = 0{\cdot}19\ m$, approximate solutions of the resulting effective mass Schroedinger equation are obtained. The accuracy of the solutions was tested in the limiting cases where $m_2/m_1 = 1$ and 0 respectively. The nature of the resulting states and their degeneracy is discussed in some detail, taking into account the fact that the conduction band of Si has six equivalent minima. Experimentally measured ionization energies show that the effective mass theory is seriously in error in the case of the ground state. This error is attributed to failure of the effective mass theory near the donor nucleus, and allowance for this failure is made in the case of higher states. This leads finally to a theoretical spectrum for the electrons bound by P, As, or Sb donors."

537.311.33 : 546.289 **3304**

Germanium.—F. Szekely. (*J. Instn elect. Engrs*, July 1955, Vol. 1, No. 7, pp. 454–457.) A short account of processes for extracting Ge and preparing it for use in electronic devices.

537.311.33 : 546.289 **3305**

Growth of Monocrystals of Germanium from an Undercooled Melt.—E. Billig. (*Proc. roy. Soc. A*, 10th May 1955, Vol. 229, No. 1178, pp. 346–363.) By dipping a properly orientated seed crystal into an undercooled melt and withdrawing it at the same rate as it grows, monocrystals of unlimited length are obtained, with shapes which may be controlled. The technique is applicable to the dendritic growth of monocrystals in materials of low coordination number, having the diamond structure. Growth occurs by layer formation. Photographs are reproduced showing that surface irregularities of some of the crystal facets obtained were <50 Å over areas a few microns across.

537.311.33 : 546.289 **3306**

Preparation of Germanium by Fusion Electrolysis.—J. L. Andrieux & M. J. Barbier-Andrieux. (*C. R. Acad. Sci., Paris*, 1st June 1955, Vol. 240, No. 22, pp. 2104–2106.) Experiments are described which indicate that Ge can be prepared electrolytically either from GeO_2 in a borate or alkali silicate solution or from fused alkali germanates.

537.311.33 : 546.289 **3307**

Note on the Shift of Band Edge of Germanium with Temperature.—M. Tomura & E. Otsuka. (*J. phys. Soc. Japan*, April 1955, Vol. 10, No. 4, pp. 313–314.) Calculations based on conductivity data, but taking account of variations of carrier mobility with temperature and of nonsphericity of energy surfaces, give a value for the temperature variation of the energy gap approaching that obtained from optical data.

537.311.33 : 546.289 **3308**

Hall Mobility of Optically Excited Carriers in Germanium.—W. W. Tyler & R. Newman. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 961–965.) Hall-coefficient measurements on high-resistivity Ge doped with Au, Fe, Cu and Ni were made over the temperature range 54°–200°K. The results suggest that hole trapping is primarily responsible for the intrinsic photosensitivity in both *n*- and *p*-type specimens, and are generally consistent with the assumption that these impurities each introduce two acceptor states in Ge.

537.311.33 : 546.289 **3309**

Electron Capture Probability of the Upper Copper Acceptor Level in Germanium.—R. M. Baum & J. F. Battey. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 923–925.) When Ge specimens are prepared by diffusing Cu into *n*-type material until the upper acceptor levels introduced by the Cu are approximately half populated [3263 of 1954 (Battey & Baum)] the bulk lifetime of the carriers decreases exponentially with increasing temperature. A suggested interpretation is that only electrons of energy >0·22 eV above the bottom of the conduction band can enter the second Cu acceptor level.

537.311.33 : 546.289 **3310**

Ring Diffusion as the Mechanism of Self-Diffusion in Germanium.—S. Mayburg. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1134–1135.)

537.311.33 : 546.289 **3311**

Attempt to detect High Mobility Holes in Germanium using the Drift Mobility Technique.—N. J. Harrick. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 1131–1133.) Experiments are reported which yielded a negative result.

537.311.33 : 546.289 : 535.37 **3312**

Infrared Phosphorescence of Germanium at Low Temperatures.—R. Kessler. (*Z. Naturf.*, Jan. 1955, Vol. 10a, No. 1, pp. 87–88.) Experiments are reported in which various Ge specimens were illuminated intermittently by radiation of wavelength 1·9–2·8 μ while subjected to cooling and heating. An increase in the 'transmitted' radiation intensity over the temperature range from about − 150°C to about − 70°C during the heating is interpreted as a phosphorescence effect possibly due to electrons 'frozen in' in the metastable state giving rise to recombination radiation.

537.311.33 : 546.46-31 **3313**

Electrical Conductivity and Thermo-electric Motive Force in MgO Single Crystal.—E. Yamaka & K. Sawamoto. (*J. phys. Soc. Japan*, March 1955, Vol. 10, No. 3, pp. 176–179.) Conductivity measurements over the temperature range 650°–1 000°C indicate a value of 2·3 eV for the work function. The sign of the thermo-e.m.f. indicates that the charge carriers are electrons. Values of the thermo-e.m.f. for different samples range from 0·1 to 10 mV/°C.

537.311.33 : [546.682.86 + 546.621.86 **3314**

Cleavage of the A^{III} B^{V} Compounds InSb and AlSb.—H. Pfister. (*Z. Naturf.*, Jan. 1955, Vol. 10a, No. 1, pp. 79, 8b.) The nature of the bonds in these two crystals is intermediate between that of diamond and that of ZnS. Both crystals are found experimentally to be characterized by (110) cleavage. Microphotographs of cleavage surfaces are reproduced.

537.311.33 : 546.682.86 **3315**

Infrared Absorption of Indium Antimonide.—W. Kaiser & H. Y. Fan. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 966–968.) Report of measurements on large *n*-type and *p*-type crystallites with a range of carrier concentrations, at temperatures between 5° and 500°K and wavelengths between 3 and 35 μ. Possible absorption mechanisms are discussed.

537.311.33 : 546.811 : 539.17 **3316**

Effect of Reactor Irradiation on the White-to-Grey Tin Transformation.—J. Fleeman & G. J. Dienes. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 652–654.) The transformation from white tin to grey tin is found to be greatly accelerated by preliminary irradiation in a low-temperature reactor.

537.311.33 : 548.73 **3317**

The Study of Semiconductor Crystal Perfection by X-Ray Diffraction Methods.—P. J. Holmes. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, pp. 180–181.) Use of a narrow, parallel X-ray beam enables both orientation and degree of perfection to be determined from a single photograph. The limit of angular resolution is set by the angle of convergence of the beam. Mechanical scanning enables large surfaces to be examined rapidly.

538.22 : 546.3-1-73-56 **3318**

The Magnetic Moments of Cobalt-Copper Alloys.—J. Crangle. (*Phil. Mag.*, May 1955, Vol. 46, No. 376, pp. 499–513.)

538.22 : 621.318.134 **3319**

Study of Rare-Earth Ferrites in the Paramagnetic Range.—R. Benoit. (*C. R. Acad. Sci., Paris*, 20th June 1955, Vol. 240, No. 25, pp. 2389–2390.) The observed variation of susceptibility with temperature is consistent with theory proposed by Néel (3275 of 1954).

538.221 **3320**

The Jordan After-Effect in Ferromagnetic Sheet Material.—R. Feldtkeller & G. Sorger. (*Z. angew. Phys.*, Sept. 1954, Vol. 6, No. 9, pp. 390–396.) Investigations are reported mainly on an Fe-Ni alloy containing 36% Ni, treated in various ways, which exhibits the effect clearly; complex permeability was measured as a function of frequency, field strength and temperature. Results support the view that the effect is due to delayed Barkhausen jumps caused by thermal fluctuations of the magnetization.

538.221 **3321**

Ferromagnetic Domain Patterns on Single Crystals and Bicrystals of Nickel.—U. M. Martius & K. V. Gow. (*Canad. J. Phys.*, May 1955, Vol. 33, No. 5, pp. 225–234.)

538.221 **3322**

Domain Patterns on Rolled Single Crystal of Ni_3Fe.—S. Chikazumi & K. Suzuki. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, p. 1130.)

538.221 : 538.632 **3323**

Effect of Ordering on Hall Effect in Ferromagnetics.—N. S. Akulov & A. V. Cheremushkina. (*C. R. Acad. Sci. U.R.S.S.*, 1st May 1955, Vol. 102, No. 1, pp. 45–47. In Russian.) Theoretical considerations show that in cases when the saturation magnetization is independent of the ordering process, the variation of Hall e.m.f. and ohmic resistance with quenching temperature will be similar. This was observed in an Fe_3Al (13·6% Al) specimen at 18°C and − 195°C.

538.221 : 538.66 **3324**

The Heat Changes accompanying Magnetization Processes in Ferrites.—L. F. Bates & N. P. R. Sherry. (*Proc. phys. Soc.*, 1st May 1955, Vol. 68, No. 425B, pp. 304–309.) Ni-Zn ferrites were investigated by a method outlined by Bates (914 of 1951). The effects may be explained, as in the case of metals, in terms of the changes of intrinsic magnetization with field. Domain rotational effects make only a very small contribution. An anomalous low-field effect previously found in certain metals [*Rev. mod. Phys.*, 1953, Vol. 25, p. 17 (Bates & Marshall)] occurs also in some of the ferrites.

538.221 : 621.318.124 **3325**

Ferroxdure II and III, Anisotropic Permanent Magnet Materials.—A. L. Stuijts, G. W. Rathenau & G. H. Weber. (*Philips tech. Rev.*, Nov./Dec. 1954, Vol. 16, Nos. 5/6, pp. 141–147.) Ferroxdures (magnadurs) with high remanence are produced by press-forming the powdered material, previously ground so that the diameter of the grains is less than the critical value for the formation of the Bloch walls, in a magnetic field before sintering.

538.221 : 621.318.124 **3326**

Ferromagnetic Resonance in Ferroxdure.—M. T. Weiss & P. W. Anderson. (*Phys. Rev.*, 15th May 1955, Vol. 98, No. 4, pp. 925–926.) Experiments were made at frequencies from 9 to over 50 kMc/s, with the magnetic field at various angles to the axis of the hexagonal crystal. With no applied field resonance occurs near 50 kMc/s; with the field perpendicular to the axis double resonance occurs for frequencies below 50 kMc/s; with the field along the axis a single resonance occurs above 50 kMc/s. A theoretical explanation is advanced.

538.221 : 621.318.134 **3327**

Relaxation Phenomena in Ferrites.—A. M. Clogston. (*Bell. Syst. tech. J.*, July 1955, Vol. 34, No. 4, pp. 739–760.) The mechanism suggested e.g. by Galt et al. (2446 of 1954) for the losses observed in ferromagnetic resonance and domain-wall motion in single crystals of Ni ferrite containing small amounts of divalent Fe is critically discussed. Expressions for the velocity of domain-wall motion, for the line width in ferromagnetic resonance and for the displacement of the field for resonance are deduced from a theory based on a thermodynamic model.

538.221 : 621.318.134 **3328**

A Note on the Rectangular Magnetization Loop of Ferrite Cores.—M. Kornetzki. (*Frequenz*, March 1955, Vol. 9, No. 3, pp. 81–83.) It is pointed out that the so-called rectangular loops of commercially available Mg-Mn-ferrite cores are not rectangular in the strict sense applicable to the loops of oriented-structure magnetic metals. The remanence value of 0·9 is obtained only for weak applied fields up to a few oersted, and falls to about 0·6 if the remanent magnetization is related to the true strong-field saturation magnetization. The low slope of the upper and lower branches of the loop is probably due to high crystal energy and sudden initiation of irreversible inversion of magnetization at a field strength near the coercive force.

538.221 : 621.318.134 **3329**

The Effective Parameters of Nickel Ferrites in the Frequency Range 0–1 000 Mc/s.—J. Rozes. (*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 374–378.) The variation of permeability and loss factor with frequency is shown in curves for various fernilites [1827 of 1954 (Lescroël)]. Some permeability measurements are also reported.

538.221 : 681.142 **3330**

Magnetic Materials for Digital-Computer Components: Part 2—Magnetic Characteristics of Ultra-thin Molybdenum-Permalloy Cores. — N. Menyuk. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 692-697.) Observations of the flux-reversal characteristics were made for tapes of various thicknesses at seven temperatures in the range −196° to + 270°C. The results indicate that the eddy-current contribution to the switching delay falls by about 50% and the spin-relaxation contribution by about 20% between the lower and upper ends of the temperature range. This behaviour gives support to the theory presented in part 1 [1713 of June (Menyuk & Goodenough)].

539.234 **3331**

Deposition of Thin Films in Vacuum.—R. P. Henry. (*Le Vide*, May/June 1955, Vol. 10, No. 57, pp. 50–63.) A survey of the different available types of plant, evaporation techniques and applications of evaporated films.

549.514.5 : 534.2-8 **3332**

Ultrasonic Absorption in Fused Silica at Low Temperatures and High Frequencies.—O. L. Anderson & H. E. Bömmel. (*J. Amer. ceram. Soc.*, 1st April 1955, Vol. 38, No. 4, pp. 125–131.)

549.514.5 : 539.16 **3333**

Effects of Nuclear Reactor Exposure on some Properties of Vitreous Silica and Quartz.—W. Primak, L. H. Fuchs & P. Day. (*J. Amer. ceram. Soc.*, 1st April 1955, Vol. 38, No. 4, pp. 135–139.)

621.315.613.1(52) **3334**

Synthetic Mica Research in Japan.—T. Noda. (*J. Amer. ceram. Soc.*, 1st April 1955, Vol. 38. No. 4, pp. 147–152.) Experimental work resulting in the synthesis of various types of mica is described; measurements of their properties are reported and an indication is given of their uses.

621.318.1 **3335**

Moulded Magnetic Materials.—G. R. Polgreen. (*G.E.C. J.*, April 1955, Vol. 22, No. 2, pp. 117–127; *Elect. Rev., Lond.*, 13th May 1955, Vol. 156, No. 19, pp. 809–814.) The mechanical, magnetic and electrical properties of mouldings made from ferrite, iron, and iron-alloy powders are compared with those of steel-group materials in solid or sheet form. The advantages of the moulded materials are pointed out. See also 762 of 1953.

621.318.26 : 538.221.096 **3336**

Effect of Low Temperature on the Stability of Permanent Magnets.—A. G. Clegg. (*Brit. J. appl. Phys.*, April 1955, Vol. 6, No. 4, pp. 120–123.) The effect of temperature cycling between 60°C and − 60°C on the magnetization of alcomax III, columax, alnico, and 35% and 15% cobalt steels was investigated experimentally. Irreversible effects occur in some cases; the losses may be minimized by partial demagnetization in an alternating field thus ensuring reversibility after the first cycle. The results are presented graphically.

537.228.1 : 621.372.412 **3337**

Handbook of Piezoelectric Crystals for Radio Equipment Designers. [Book Review] — J. P. Buchanan. Publishers: Office of Technical Services, U.S. Dept of Commerce, Washington, D.C., 1954, 524 pp. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 1026–1027.) "It should be of equal value both for military and commercial applications, to the crystal engineer and to the crystal manufacturer."

MATHEMATICS

517.564.4 **3338**

Bounds of the Legendre Function.—K. M. Siegel. (*J. Math. Phys.*, April 1955, Vol. 34, No. 1, pp. 43–49.) When inequalities involving Legendre functions are used for analysing scattering problems, it is commonly found that the upper bounds are functions of both the degree and the argument of the Legendre function. Inequalities are here presented which are functions of only the degree of the Legendre function.

517.564.4 : 621.385.832 **3339**

Two Formulae involving Generalized Legendre Functions of Integral and Nonintegral Index.—G. C. Sponsler. (*J. Math. Phys.*, April 1955, Vol. 34, No. 1, pp. 50–53.) The formulae discussed were established in the course of an investigation of the potential distribution within a c.r. tube with a helically wound post-deflection accelerator.

517.6 **3340**

On Certain Integrals of Lipschitz-Hankel Type involving Products of Bessel Functions.—G. Eason, B. Noble & I. N. Sneddon. (*Phil. Trans. A*, 19th April 1955, Vol. 247, No. 935, pp. 529–551.)

517.9 **3341**

A Differential Equation for Undamped Forced Nonlinear Oscillations: Part 1.—G. R. Morris. (*Proc. Camb. phil. Soc.*, April 1955, Vol. 51, Part 2, pp. 297–312.)

517.9 **3342**

A New Graphical Solution of Ordinary Linear Differential Equation of the Second Order.—I. Oshida. (*J. phys. Soc. Japan*, March 1955, Vol. 10, No. 3, pp. 228–232.)

517.948 **3343**

The *N*-Step Iteration Procedures.—E. J. Craig. (*J. Math. Phys.*, April 1955, Vol. 34, No. 1, pp. 64–73.) A new procedure for solving simultaneous linear equations is presented, and the relations between previously presented procedures are discussed.

517 **3344**

Die konfluente hypergeometrische Funktion mit besonderer Berücksichtigung ihrer Anwendungen. Ergebnisse der angewandten Mathematik. Vol. 2. [Book Review]—H. Buchholz. Publishers: Springer, Berlin, 1953, 234 pp., 36 DM. (*Z. angew. Phys.*, Sept. 1954, Vol. 6, No. 9, p. 431.) This book deals with an important class of functions, including parabolic functions, and is described as an indispensable tool in h.f. theory.

517.63 **3345**

Laplace Transforms for Electrical Engineers. [Book Review]—B. J. Starkey. Publishers: Iliffe, London, 1954, 280 pp., 30s. (*Frequenz*, April 1955, Vol. 9, No. 4, p. 132.) An introduction to the subject.

MEASUREMENTS AND TEST GEAR

621.314.7 : 621.317.725 **3346**

Transistor Voltmeters.—M. H. N. Potok & R. A. McF. Wales. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 344–346.) Experimental a.c. and d.c. voltmeters using a junction-transistor current amplifier are described. The maximum sensitivity is about 1 MΩ/V; the power consumption is < 1 mW.

621.317.3 : 621.3.018.78 **3347**

Methods for Measurement of Nonlinearity Distortion in the A.F. Range.—A. Darré. (*Frequenz*, March & April 1955, Vol. 9, Nos. 3 & 4, pp. 84–94 & 127–131.) Methods surveyed include those using single-tone, double-tone, multitone and noise test sources. Tables show the relations between the results obtained by the different methods, as well as the precautions necessary in applying them and their applicability for testing various pieces of equipment.

621.317.3 : 621.372.8 **3348**

Measurements in Travelling-Wave Structures.—Aikin. (See 3155.)

621.317.33 **3349**

A New Method for measuring Electrical Resistivities.—K. G. Ramanathan & J. S. Dhillon. (*Nature, Lond.*, 28th May 1955, Vol. 175, No. 4465, p. 948.) A method particularly useful in cases where it is difficult to attach terminals to the specimen involves inducing a momentary e.m.f. in a ring specimen suspended in a magnetic field and observing the ballistic throw.

621.317.335.029.64 **3350**

Measurement of High-Permittivity Dielectrics at Microwave Frequencies.—F. E. Harris & C. T. O'Konski. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 482–485.) Transmission coefficients of liquid samples contained between mica windows in short sections of a waveguide were measured at wavelengths between 1 and 10 cm by mixing the transmitted signal with one of fixed amplitude and phase travelling in the opposite direction. Solutions are obtained graphically.

621.317.335.3.029.6 : 551.571 **3351**

Measurement at 9 000 Mc/s of the Dielectric Constant of Air containing Various Quantities of Water Vapor.—S. Saito. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, p. 1009.) A cavity-resonator comparison method is described; the value found for the dielectric constant of dry air under standard conditions is 1·000574 ± 0·0000025. An empirical formula is established for the variation with humidity; use of the method for industrial measurements of humidity is reported.

621.317.335.3.029.6 : 621.372.413 **3352**

Measurement of Dielectric Constants by Splitting of Degenerate Modes.—M. Schröder. (*Z. angew. Phys.*, April 1955, Vol. 7, No. 4, pp. 169–174.) A development of the cavity Q-meter method of measurement is described. The dielectric, when placed inside the cavity, produces changes in the initially equal frequencies of the two modes present; since these changes are different, frequency splitting results. A formula is given for the dielectric constant in terms of the relative frequency separation and the specimen volume. The experimental arrangement is described and some results obtained with plexiglas and trolitul are given. The method was also used for loss-angle determinations.

621.317.335.3.029.63/.64 **3353**

A Simple and Rapid Method of Measuring the Complex Permittivity of a Liquid.—E. H. Grant. (*Brit. J. appl. Phys.*, May 1955, Vol. 6, No. 5, p. 181.) A simplification of the method previously described [2361 of August (Buchanan & Grant)].

621.317.42 : 621.385.833 **3354**

Measurement of the Induction and its Derivatives in the Plane of Symmetry of Cylindrical Magnetic Lenses.—P. Gautier. (*C. R. Acad. Sci., Paris*, 13th June 1955, Vol. 240, No. 24, pp. 2294–2296.) Analysis shows that certain methods described for investigating magnetic lenses with rotational symmetry [e.g. 1743 of 1953 (Durandeau)] can be used for measurements on cylindrical lenses.

621.317.44.082/.084 **3355**

Measurement of Magnetic Field Gradients.—J. F. Frazer, J. A. Hofmann, M. S. Livingston & A. M. Vash. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 475–476.) The device comprises a small search coil vibrated at about 100 c/s by a loudspeaker, an amplifier and a pen recorder. An accuracy within $\frac{1}{2}$% can be obtained.

621.317.444 : 538.71 **3356**

A Simple, Sensitive, Saturated-Core Recording Magnetometer.—V. B. Gerard. (*J. sci. Instrum.*, May 1955, Vol. 32, No. 5, pp. 164–166.) Using a high-permeability core which is saturated every half cycle by a sinusoidal primary voltage, the amplitude of the second harmonic in the resulting secondary waveform is proportional to the ambient magnetic field. By exciting two parallel cores in opposition, and by using negative feedback, high stability is obtained.

621.317.7 : 621.385 **3357**

A New Electron-Optical Bench.—E. B. Baş. (*Z. angew. Phys.*, Sept. 1954, Vol. 6, No. 9, pp. 404–409.)

621.317.7.029.6 **3358**

New High-Frequency Measurement Apparatus for Radio-Communication Systems.—H. G. Thilo & K. Thalmayer. (*Frequenz*, March 1955, Vol. 9, No. 3, pp. 69–80.) A review covering signal generators and voltage-, frequency- and impedance-measuring and associated apparatus for testing radio-communication equipment for frequencies up to 10 kMc/s.

621.317.72/.73 **3359**

Application of the Theory of the Reflectometer.—H. Wolf. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 221–227.) Continuation of work described previously (1443 of May). Loose coupling is found to be necessary between the main and auxiliary lines. The permissible degree of mismatch at the ends of the auxiliary line is investigated; for measurements on either the forward or reflected wave alone it is sufficient if only the remote end of the auxiliary line is terminated by its characteristic impedance. A method of equalizing the sensitivity/frequency characteristic is discussed. Procedure for voltage measurement is outlined.

621.317.729 : 621.385.832 **3360**

Trajectory-Tracer Study of Helix- and Band-Type Post-Deflection Acceleration.—Sponsler. (See 3456.)

621.317.733 **3361**

A Square-Wave Inductance Bridge.—K. Lamont. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 357–359.) The bridge described is based on an earlier design by Roddam (942 of 1950). It covers an inductance range from 10 mH to 100 H in four steps, a choice being available between a 50-c/s or a 10-kc/s square wave having a 10/90 mark-space ratio, or a 1-kc/s square wave with a 50/50 ratio. This arrangement is useful for measurements on small transformers.

621.317.742 **3362**

Rotatable Inductive Probe in Waveguides.—F. J. Tischer. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 974–980.) "It is shown by calculation of the field distribution in waveguides with TE waves in the presence of both the forward and the reflected waves that the voltage induced in a pure inductive probe depends on its angular position in the same manner that a probe in a slotted line depends on its axial position. Thus, a rotatable probe consisting of a wire loop and a compensating arrangement extending through an aperture into the waveguide can be used as a standing wave detector."

621.317.755 **3363**

American Oscilloscope Technique.—A. J. Reynolds. (*Wireless World*, Sept. 1955, Vol. 61, No. 9, pp. 441–443.) Short descriptions are included of some models capable of dealing with wide-band signals with fast rise times.

621.317.755.087.4 **3364**

Production of Stationary Oscillograph Traces of Arbitrary Processes recorded on Magnetic Tape.—K. Löffler. (*Elektronik*, April 1955, Vol. 4, No. 4, pp. 73–77.) A small portion of the tape record is reproduced repeatedly by means of a magnetic head mounted on a swinging arm. The output signal is fed to the Y plates of the c.r.o.; the timebase is obtained by means of an electromechanical device coupled to the swinging arm. Sketches of the mechanical arrangements used are shown.

621.317.761 : 621.374.3 **3365**

Display of Pulse Intervals in Neurophysiological Experiments.—L. Haapanen & C. R. Skoglund. (*Nature, Lond.*, 14th May 1955, Vol. 175, No. 4463, pp. 858–859.) An amplifier and phase inverter are followed by an amplitude discriminator and 200-μs pulse generator. The first pulse of a train triggers both the horizontal timebase and a slow-running vertical timebase of a c.r.o., and each pulse modulates the beam intensity. The distance between successive dots on the screen is a measure of the pulse interval, regular and random variations being identified by the general configuration of dots.

621.317.799 : 621.397.61 **3366**

Monitoring Television Transmitters with the Nyquist Test Demodulator.—Griese. (See 3417.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.317.39 : 531.71 **3367**

History of Electrical Devices for measuring Strains and Small Movements.—B. E. Noltingk. (*J. sci. Instrum.*, May 1955, Vol. 32, No. 5, pp. 157-158.) Includes 34 references.

621.317.39 : 534.13-6 **3368**

Electrical Methods for Vibration Measurement and Frequency Analysis at Very Low Frequencies.—W. Mühe. (*Frequenz*, May 1955, Vol. 9, No. 5, pp. 146–157.) Mechanical vibrations at infrasonic and low audio frequencies produce variations of the mutual inductance of a pair of coils included in a carrier-frequency system. The signals corresponding to the vibrations are stored on magnetic tape and can be analysed down to 1/150 c/s with a resolution of 1/500 c/s by varying the tape speed.

621.383 + 535.37 **3369**

New Light Amplifiers.—S. Heller. (*Radio-Electronics*, May 1955, Vol. 26, No. 5, pp. 45–47.) Image-intensifier devices described include one using ultraviolet light to excite a charged ZnS screen, a cell comprising photoconductor and electroluminescent-phosphor layers for use at wavelengths in the visible range, and others based on photo-electron multipliers.

621.384.6 **3370**

High-Energy Particle Accelerators.—J. Cockcroft & T. G. Pickavance. (*Endeavour*, April 1955, Vol. 14, No. 54, pp. 61–70.) Descriptions are given of the main types; examples of applications are included.

621.384.6 **3371**

Projects for Accelerating Machines.—(*Nuovo Cim.*, 1955, Vol. 2, Supplement, No. 1, pp. 339–469.) The following papers are included:—

CERN, the European Council for Nuclear Research (pp. 339–354).—E. Amaldi. In English.

The Alternating-Gradient Proton Synchrotron (pp. 355–374).—J. B. Adams. In English.

Experimental Facilities of the CERN Proton Synchrotron (pp. 375–391).—A. Citron & M. G. N. Hine. In English.

Theory of Particle Orbits in the Alternating-Gradient Synchrotron (pp. 392–402).—G. Lüders. In English.

Synchrocyclotrons and the CERN 600-MeV Machine (pp. 403–412).—T. G. Pickavance. In English.

Proton Linear Accelerators for Nuclear Research and the A.E.R.E. 600-MeV Project (pp. 413–422).—T. G. Pickavance. In English.

Proton Synchrotron Project for Saclay (pp. 423–441).—H. Bruck & R. Lévy-Mandel. In French.

The Italian Design of a 1 000-MeV Electronsynchrotron: a Comparison between the Strong and the

Weak Focusing (pp. 442–458).—G. Salvini. In English.

A Theory of the Capture in a High-Energy Injected Synchrotron (pp. 459–469).—E. Persico. In English.

621.384.612 **3372**

Giant Synchrotrons or Cosmotrons.—P. Grivet. (*Rev. gén. Élect.*, May 1955, Vol. 64, No. 5, pp. 239–262.) A survey covering electron and proton synchrotrons and the strong-focusing type for ions, with special reference to the 25-kMeV equipment under development at Geneva.

621.384.612 **3373**

The Stability of Orbits in the Strong-Focusing Synchrotron.—J. Seiden. (*Ann. Phys., Paris*, March/April 1955, Vol. 10, pp. 259–304.)

621.384.622.1 **3374**

Cavity Accelerator.—J. Pottier. (*Nuovo Cim.*, 1st May 1955, Vol. 1, No. 5, pp. 949–952. In French.) Outline description of a small linear accelerator with a single cavity, capable of accelerating electrons and other relatively light particles up to energies of 200–300 keV.

621.384.622.2 : 621.372.8 **3375**

Phase Velocity and Shunt Impedance of a Waveguide with Helix for a Linear Proton Accelerator (for Energy about 50 MeV).—Septier. (See 3156.)

621.385.833 **3376**

Measurement of Chromatic-Aberration Constants of Magnetic Lenses.—H. Watanabe & N. Morito. (*Optik, Stuttgart*, 1955, Vol. 12, No. 4, pp. 166–172.)

621.385.833 **3377**

Some Properties of Electrostatic Univoltage Lenses with Axial Potentials close to Cathode Potential.—W. Lippert. (*Optik, Stuttgart*, 1955, Vol. 12, No. 4, pp. 173–180.) Characteristics calculated for simple cases are in good agreement with measured values. Five experimentally determinable parameters are indicated by which the lenses can be characterized. The discussion is relevant to velocity-filter lenses.

621.385.833 **3378**

A Theory on Image Formation of Electron Microscope.—R. Uyeda. (*J. phys. Soc. Japan*, April 1955, Vol. 10, No. 4, pp. 256–264.) A treatment is presented based on the formation of the image from the images of the individual atoms of the specimen.

621.385.833 : 537.533 **3379**

Thermionic Emission Microscopy of Metals: Part 1—General.—R. D. Heidenreich. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 757–765.) An emission-type electron microscope has been designed on the basis of observations that the thermionic-emission properties of an underlying metal make themselves evident through a BaO coating of thickness less than about 100 Å.

621.385.833.087 **3380**

Surface Examination by Reflection Electron Microscopy.—J. S. Halliday. (*Engineer, Lond.*, 22nd April 1955, Vol. 199, No. 5178, pp. 569–573.) An illustrated account of the method.

621.387.424 **3381**

Temperature Coefficient of External-Cathode Organic-Vapour-Filled Geiger-Müller Counters.—D. Blanc & R. Viste. (*C. R. Acad. Sci., Paris*, 20th June 1955, Vol. 240, No. 25, pp. 2405–2407.)

621.396.91 : 621.398 **3382**

A Radio Sonde for Meteorological Observations.—A. Hauer & M. van Tol. (*Philips tech. Rev.*, Nov./Dec. 1954, Vol. 16, Nos. 5/6, pp. 148–156.) Details are given of a model developed in collaboration with the Dutch Meteorological Institute.

642.6 : 681.142 **3383**

Language Translation by Electronics: Novel Application of Digital Computing Machines.—J. P. Cleave & B. Zacharov. (*Wireless World*, Sept. 1955, Vol. 61, No. 9, pp. 433–435.) The problem is discussed with particular reference to technical translations into English.

PROPAGATION OF WAVES

538.566 + 534.2 **3384**

General Relation between Absorption and Dispersion of Sound Waves.—Ginzburg. (See 3129.)

621.396.11 : 535.42 **3385**

Phase Relations in the Diffraction Shadow.—E. Berg. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 227–230.) Calculations are made of the phase surfaces in the shadow zone beyond the horizon for a vertical magnetic-dipole radiator. Infinite ground conductivity and a uniform atmosphere are assumed. Numerical results are given for a dipole height of 100 m and $\lambda = 6\pi$ m. The theory is relevant to radio-navigation methods.

621.396.11 : 551.510.535 **3386**

Comment on the Theory of Radio-Wave Interaction.—L. G. H. Huxley (*Proc. roy. Soc. A*, 10th May 1955, Vol. 229, No. 1178, pp. 405–407.) Recent measurements [106 of 1954 (Crompton et al.)] showing how the mean energy lost by an electron in a collision with a gas molecule depends upon the excess of the mean energy of the electron over that of a gas molecule give results which are not consistent with observations of cross-modulation phenomena in the ionosphere. Possible explanations are discussed. See also 231 of 1954.

621.396.11 : 551.510.535 **3387**

An Improved Chart for Ionospheric Forecasting in the British Zone.—R. Naismith. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 503–504.) "In the international 3-zone system of presenting forecasts of radio-wave transmission conditions, the necessity to provide average values over a range of longitudes introduces errors. These errors can be eliminated for the region of the United Kingdom by the use of a British Zone Chart (B.Z.C.) which presents the predictions directly for all 2000-km control points around London. A comparison by various user organizations showed that, over a test period of six months, the standard deviation between the predicted and observed conditions was approximately halved when the B.Z.C. was used."

621.396.11 : 551.510.535 **3388**

Some Comparative Directional Measurements on Short Radio Waves over Different Transmission Paths.—E. N. Bramley. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 544–549. Discussion, pp. 550–554.) "Observations on first- and second-order F-layer echoes from a pulsed transmitter at frequencies of 5–8 Mc/s have been made at two direction-finders separated by 213 km. From a comparison of first-order bearings over the two paths it has been found that negligible correlation exists between similar components of the random ionospheric tilts at points separated by 106 km. However, relatively small average tilts over a period of an hour have been found to occur, and these are correlated over wide areas; they show a regular diurnal variation. The mid-points of the two transmission paths lay on land and on sea respectively, and a comparison of the directional variations exhibited by the second-order echo showed that the land behaved as a rougher reflector than the sea. The resulting difference in the total variance of bearings on this echo for the two paths was, however, small, as the deviations were mainly caused by ionospheric tilts."

621.396.11 : 551.510.535 : 621.396.93 **3389**

Some Aspects of the Rapid Directional Fluctuations of Short Radio Waves reflected at the Ionosphere.—E. N. Bramley. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 533–540. Discussion, pp. 550–554.) Measurements on single-component first-order ionospheric echoes at vertical and oblique incidence indicate that the r.m.s. angular deviations are of the order of 1° or less under quiet ionospheric conditions but are appreciably greater under ionospheric-storm or spread-F conditions. The fluctuations are uncorrelated at an interval of 5 sec. A layer of irregular ionization density within region E would account for the quiet-condition F-layer results, and this would require random variations of the phase path through the region of the order of only 3 m at a frequency of 5 Mc/s. The E-layer result appears to be affected by partial reflections at different levels within the region. The application to direction finding is discussed.

621.396.11.029.45 : 551.510.535 **3390**

The Numerical Solution of the Differential Equations governing the Reflexion of Long Radio Waves from the Ionosphere: Part 2.—K. G. Budden. (*Phil. Trans. A*, 12th May 1955, Vol. 248, No. 939, pp. 45–72.) Continuing the program of work outlined in part 1 (2402 of August), theoretical and experimental results for a frequency of 16 kc/s are compared. The calculations assume that the earth's magnetic field is vertical and that the ionospheric electron collision frequency is constant. The effect of these conditions is discussed; the assumption of a vertical magnetic field is untenable at the frequency considered, for latitudes such as those of England. Calculated results for an ionosphere model in which the electron density increases exponentially with height give poor agreement with observations, further calculations postulating a D layer with maximum electron density at 40 km below the maximum of a Chapman E layer afford a more promising basis for further work.

621.396.11.029.55 : 551.510.535 **3391**

Focusing of Waves in Radio Reception.—H. V. Griffiths. (*Nature, Lond.*, 28th May 1955, Vol. 175, No. 4465, pp. 948–949.) Occasional observations of abnormally strong signals received from Sofia on 9·7 Mc/s at Tatsfield in Kent are reported. Peak values may reach 20–30 mV/m or more, as compared with the normal peaks of 1–1·5 mV/m. The effect has been ascribed to focusing action by the ionosphere.

621.396.11.029.62 : 523.5 **3392**

Forward Scattering of Radio Waves by Meteor Trails.—P. A. Forsyth & E. L. Vogan. (*Canad. J. Phys.*, May 1955, Vol. 33, No. 5, pp. 176–188.) Typical results are presented of experiments made using v.h.f. transmissions over several paths with lengths of the order of 1 000 km. Recorded characteristics of individual signals are shown.

621.396.81 : [523.746 + 550.385 **3393**

A Study of Commercial Time Lost on Transatlantic Radio Circuits due to Disturbed Ionospheric Conditions.—J. K. S. Jowett & G. O. Evans. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 505–512. Discussion, pp. 522–528.) An analysis of time lost on circuits between the U.K. and N. America during the period 1942–1952, in relation to variations in solar and geomagnetic activity, indicates that most time is lost during winter as the sunspot-cycle minimum is approached, the greatest losses being associated with periods of high magnetic activity arising from the occurrence of M-region storms. It is expected that by the winter of 1955–1956 there should be a marked reduction of the time lost on transatlantic circuits.

621.396.81 : [523.746 + 550.385 **3394**

Performance Characteristics of High-Frequency Radiotelegraph Circuits.—A. M. Humby, C. M. Minnis & R. J. Hitchcock. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 513–522. Discussion, pp. 522–528.) Data for some long-distance circuits have been analysed in relation to variations in solar and magnetic activity. Lowest operational efficiency does not always occur at the same time as least solar activity. Seasonal variations of the difference between the circuit performances for the two directions are discussed in relation to ionosphere conditions, atmospheric noise, and the particular ray path. Difficulties due to forward and backward echoes are mentioned. The advantages of restricting the maximum latitude of the ray path during magnetically disturbed conditions are emphasized. The possibility of propagation by reflections between ionospheric layers in some cases is indicated.

621.396.81.029.55 : 523.78 **3395**

Change of Radio Signal Strength during Solar Eclipse 30th June 1954.—A. N. Karnov. (*Priroda, Moscow*, May 1955, No. 5, p. 113.) The signal strength of the 25-m-λ transmission from Moscow received at Stalingrad decreased during the eclipse down to a minimum 48 db below normal about 10 minutes after the maximum occultation. The curve shown is slightly skew, the rate of change of signal strength being greater after the minimum than before it. The signal strength was estimated by comparing the a.f. output of the receiver with the a.f. output of a calibrated signal generator.

RECEPTION

621.396.3 : 621.396.82 **3396**

Contribution to the Study of Interference due to Radiotelegraph Transmissions.—J. Marique. (*Rev. HF, Brussels*, 1955, Vol. 3, No. 1, pp. 1–16. In English.) A study is made of transients occurring in a h.f. amplifier comprising a cascade of three resonant circuits, in response to input signals of rectangular, trapezoidal, exponential and sine-squared form. The attenuation of such transients produced by detuning is generally less than that predicted from steady-state selectivity. Only with the sine-squared signal can the transients be almost entirely suppressed. For normal signalling speeds and receiver characteristics, each pulse of an interfering signal can be considered as acting separately on the receiver.

621.396.62 **3397**

Some Recent Developments in Communication-Receiver Design.—A. E. Pope. (*J. Brit. Instn Radio Engrs*, July 1955, Vol. 15, No. 7, pp. 367–376.) Improvements in frequency stability of local oscillators and in the design of tuning scales are among the developments discussed. Use of electromechanical filters is considered not yet practicable. Brief mention is made of the possible use of transistors.

621.396.812.3 **3398**

Some Observations on Diversity Reception.—B. van der Pol. (*Tijdschr. ned. Radiogenoot.*, March 1955, Vol. 20, No. 2, pp. 87–92. In English.) The improvement theoretically obtainable by use of diversity reception is discussed in terms of the percentage of time the signal falls below a specified strength. The theory is applied to the case of signals affected by Rayleigh-type fading.

621.396.82 : 621.396.41.029.62 **3399**

Interference Frequency Bands resulting from Heterodyne Effects of Higher Orders.—P. Güttinger. (*Brown Boveri Rev.*, Nov. 1954, Vol. 41, No. 11, pp. 427–432.) Discussion of design of receiver circuits and choice of intermediate frequency to minimize interference in a v.h.f. radiocommunication system with several transmitters and receivers at a station. Calculations are made of the amplitudes of interference signals corresponding to various mixing curves.

621.396.821.029.62/.63 : 551.594.6 **3400**

Thunderstorm Signals at Very-High Frequency and Ultra-high Frequency.—D. R. Hay & T. R. Hartz. (*Nature, Lond.*, 28th May 1955, Vol. 175, No. 4465, pp. 949–950.) Records are reproduced showing measurements of the strength of signals on 49, 91, 173 and 492 Mc/s, from transmitters distant about 200 miles, made during a local thunderstorm.

621.396.822 **3401**

An Approximate Joint Probability Distribution for Wave Amplitude and Frequency in Random Noise.—R. A. Wooding. (*N.Z. J. Sci. Tech. B*, May 1955, Vol. 36, No. 6, pp. 537–544.) "An approximate joint probability distribution of instantaneous wave amplitude and frequency, for random sampling from continuous-spectrum random-noise records, is derived in terms of the joint distribution of the modulus of a vector representing the wave envelope and its angular velocity. The derivation involves a complex representation of the wave envelope which may not have been published previously."

621.396.822 **3402**

Information Theory: Statistical Characteristics of a Sinusoidal Signal perturbed by Noise.—P. Hontoy & W. Lesuisse. (*Rev. HF, Brussels*, 1955, Vol. 3, No. 1, pp. 27–54.) The probability density curve is derived for a sine wave with superposed filtered noise. Numerical values are calculated for signal/noise power ratios of 5 : 1 and 15 : 1. If a ratio of 5 : 1 is obtained with a.m. it can theoretically be improved to 15 : 1 by use of f.m. Some first-order Bessel functions required for the computations are tabulated. The theory was verified by experiments using a detected sinusoidal signal with filtered Gaussian noise superposed. Good agreement was obtained for a.m; for f.m. the observed probability density is much more favourable than that predicted, provided that modulation is reduced so that only part of the filter pass band is occupied.

STATIONS AND COMMUNICATION SYSTEMS

621.376.55 : 621.396.41 **3403**

Pulse Multiplex Telephony System with High Precision and Phase Stability.—F. Carassa. (*Alta Frequenza*, April 1955, Vol. 24, No. 2, pp. 139–177.) Fundamental causes of instability and the resulting difficulties in p.p.m. systems are considered. The best method of avoiding these difficulties is to derive the pulses starting with a frequency which is a multiple of the repetition rate and to provide automatic phase control at the receiver.

621.396.5 **3404**

Overseas Telephony in Austria.—(*Radio Tech., Vienna*, May/June 1955, Vol. 31, Nos. 5/6, pp. 187–189.) Short account of system installed at the end of 1954.

621.396.712.029.55 **3405**

The New Jülich High-Power Short-Wave Broadcasting Station for the 'Deutsche Welle'.—H. Kreutzträger. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1955, Vol. 7, Nos. 3/4, pp. 53–58.) This station, under construction, includes at its first stage of development two 100-kW and one 20-kW transmitters. The use of directional aerials permits simultaneous radiation on three frequencies in five different directions in succession. The plans for the transmitters, aerials, switching arrangements, power supply and buildings are discussed.

SUBSIDIARY APPARATUS

621.311.6.025.3 : 621.3.089.68 **3406**

An Alternating-Voltage Source of High Stability at Standard Frequency.—H. J. Schrader. (*Elektrotech. Z., Edn A*, 11th May 1955, Vol. 76, No. 10, pp. 357–360.) Description of a 3-kVA three-phase 50-c/s constant-voltage source provided by a synchronous generator with quartz-clock-controlled frequency, developed for testing a.c. precision instruments.

621.314.6 : 621.372.54 **3407**

Filters for Rectifier Equipment.—P. Bingley. (*Elect. Times*, 12th May 1955, Vol. 127, No. 3314, pp. 779–781.) The design is discussed of series-tuned *LC* filters, in parallel with the output of a multiphase rectifier, for attenuating unwanted harmonic voltages. The design of a series reactor for limiting the rectifier output current is also briefly considered.

621.314.63 : 621.311.6 **3408**

Application of Germanium Power Rectifiers.—R. M. Crenshaw. (*Elect. Engng, N.Y.*, May 1955, Vol. 74, No. 5, pp. 418–422.) Essentially full text of paper published in *Trans. Amer. Inst. elect. Engrs, Applications and Industry*, March 1955, pp. 48–52. Commercially available power-supply units are described, with ratings such as 16 kA at 65 V, 12 kA at 130 V and 40 kA at 24 V.

621.316.722.1 **3409**

Electronic Voltage Regulators.—(*Tech. News Bull. nat. Bur. Stand.*, Aug. 1955, Vol. 39, No. 8, pp. 108–109.) Relatively simple circuits giving a high degree of stabilization have been designed at the National Bureau of Standards, using beam power series valves with separate screen supplies. A power-supply unit is briefly described containing four regulated sources and giving outputs of ±300 V and ±150 V.

621.316.722.1 **3410**

An A.C. Voltage Stabilizer.—A. Fuchs. (*Bull. Res. Counc. Israel*, March 1955, Vol. 4, No. 4, pp. 337–340.) High regulation factor, short response time, low weight, and frequency independence are achieved in a 3-valve regulator with a carbon-pile variable-resistor control element and local as well as overall feedback. In the form described, the regulator is suitable for supplying filament current for a large number of valves.

TELEVISION AND PHOTOTELEGRAPHY

621.397.2 : 621.372.55 **3411**

Apparatus for Correction of Linearity Distortion in Video Signals.—H. A. Laett. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st May 1955, Vol. 33, No. 5, pp. 186–192. In German and French.) Distortion experienced particularly in international exchanges of television programs, and attributed to aging of components in *RC* circuits, is corrected by deliberate introduction of complementary distortion, two integrating and three differentiating circuits being provided in parallel with the main video-signal channel.

621.397.241 **3412**

A New Local Video Transmission System.—S. Doba, Jr, & A. R. Kolding. (*Bell Syst. tech. J.*, July 1955, Vol. 34, No. 4, pp. 677–712.) The A2A line transmission system for use in short-distance television links is described. Flexibility in application is achieved by use of a series of amplifier and equalizer components which may be assembled in a variety of combinations. Frequencies up to 4·5 Mc/s are handled.

621.397.335 **3413**

Television Synchronizing Signal Generator.—W. Welsh. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 991–995.) The low-frequency pulses for keying the equalizing pulses are obtained from a train of higher-frequency pulses by means of a coincidence type of frequency-divider chain.

621.397.5 **3414**

Progress Committee Report.—C. R. Daily. (*J. Soc. Mot. Pict. Telev. Engrs*, May 1955, Vol. 64, No. 5, pp. 225–247.) This survey includes brief references to over twenty papers dealing with recent developments in television equipment, broadcasting and engineering techniques.

621.397.5 : 535.623 **3415**

Color Television Luminance Detail Rendition.—W. G. Gibson & A. C. Schroeder. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 918–923.) If the high-frequency components of the luminance signal are formed in the same way as the low-frequency components, luminance transitions may be reproduced with incorrect amplitude and may be accompanied by dark surrounds. The production of these defects is explained and an expression is derived for a luminance signal free from them.

621.397.6 **3416**

Feedback Clamp Circuit for TV.—K. R. Wendt & W. K. Squires. (*Electronics*, July 1955, Vol. 28, No. 7, pp. 182 . . 194.) A double-diode keyed clamp is placed across a cathode-follower output as an error detector, the error voltage being amplified and subtracted from the video signal to provide correction. The use of a feedback amplifier enables the time constant of the sampling circuit to be made short, while the correction is applied slowly and smoothly.

621.397.61 : 621.317.799 **3417**

Monitoring Television Transmitters with the Nyquist Test Demodulator.—H. J. Griese. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 201–206.) Description of test gear developed in West Germany having standardized characteristics corresponding to those of a high-grade domestic receiver.

621.397.611.2 **3418**

Television Pick-Up Tubes.—J. D. McGee. (*J. Instn elect. Engrs*, July & Aug. 1955, Vol. 1, Nos. 7 & 8, pp. 404–410 & 502–510.) The evolution of television camera tubes is traced and the main properties required are specified. Characteristics of the principal types in use are described.

621.397.621.2 : 535.623 : 621.385.832 **3419**

A New High-Efficiency Parallax Mask Color Tube.—M. E. Amdursky, R. G. Pohl & C. S. Szegho. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 936–943.) A colour-television picture tube is described using a post-deflection focusing system in which the aperture mask is maintained at a potential much lower than that of the phosphor screen, while an auxiliary mesh on the cathode side of the mask is maintained at anode potential, intermediate to mask and screen potentials. Improved brightness is obtained as compared with systems omitting the auxiliary mesh. The mask apertures and fluorescent screen dots are uniformly spaced over the target area. Tubes incorporating this principle have been produced with 19-in. round and 24-in. square screens.

621.397.621.2 : 535.623 : 621.385.832 **3420**

Design of Lens-Mask Three-Gun Color Television Tubes.—R. C. Hergenrother. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 943–951.) Post-deflection focusing is provided by applying an accelerating field between the aperture mask and the fluorescent screen; larger apertures can hence be used, thus reducing the proportion of electrons intercepted, improving brightness and reducing mask heating. Design of both plane and curved masks is discussed. The production and suppression of secondary electrons from the mask are considered.

TRANSMISSION

621.376.32 : 621.385.029.6 : 621.318.134 **3421**

Magnetic Tuning of Klystron Cavities.—Cacheris, Jones & Diehl. (See 3441.)

621.396.61 : 621.396.41 **3422**

New Mobile Radio Transmitter Designs.—R. L. Casselberry. (*Tele-Tech & Electronic Ind.*, May 1955, Vol. 14, No. 5, pp. 90–92 . . 124). Design of a v.h.f. transmitter for operation with either 6-V or 12-V batteries is described; high frequency stability and efficient modulation limiting are important features.

VALVES AND THERMIONICS

621.314.63 **3423**

Note on the Temperature Variation of the Reverse Current of *p-i-n* Rectifiers.—A. Herlet. (*Z. angew. Phys.*, May 1955, Vol. 7, No. 5, pp. 240–244.) Discussion of the mechanism of recombination and carrier generation based on a trap model indicates that the temperature variation of the reverse current follows a simple exponential law only if the intermediate zone is completely free from impurities.

621.314.63 : 546.289 **3424**

Reverse Current and Carrier Lifetime as a Function of Temperature in Germanium Junction Diodes.—E. M. Pell. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 658–665.) Measurements were made on a series of diodes over the temperature range from room temperature to that of liquid nitrogen. At low temperatures the value of carrier lifetime becomes constant; the observed behaviour can be explained in terms of published recombination theory [e.g. 420 of 1953 (Shockley and Read)]. The reverse-current/reciprocal-temperature characteristic comprises two straight-line sections with different slopes; its shape is consistent with charge generation by recombination centres in the space-charge region.

621.314.63 : 546.289 **3425**

The Equivalent Circuit for Slow-Acting Germanium Diodes taking account of the Transition between Forward and Blocking Operating States.—G. Kohn. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 241–245.) The circuit developed covers the case of operation with large-amplitude pulses which carry the diode characteristic past the knee. Build-up of forward conductance is represented by inductance and build-up of blocking resistance by capacitance. At the transition, which occurs at about + 0·25 V, at the knee of the static characteristic, the diode behaves as a large capacitance.

621.314.63 : 621.396.822 **3426**

Noise Measurements in Semiconductors at Very Low Frequencies.—T. E. Firle & H. Winston. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 716–717.) "The low-frequency noise spectra of germanium and silicon rectifiers have been determined. Two methods were employed: a numerical analysis according to the Wiener-Khintchine relationship, and a frequency translation photo playback method. No evidence of a deviation from a $1/f^a$ $(a>1)$ noise power law was found down to frequencies as low as 6×10^{-5} cps."

621.314.7 **3427**

The Field-Effect Transistor.—I. M. Ross. (*Bell Lab. Rec.*, May 1955, Vol. 33, No. 5, pp. 167–172.) A simple account is given of the mode of operation and the characteristics of a *p-n-p* field-effect transistor similar to those considered by Shockley (879 of 1953) and Dacey & Ross (3445 of 1953). The transverse drain current I_D flowing through the *n* material between the source and drain electrodes is controlled by a variable 'gate' produced in the *n* material by application of a voltage V_G between the *p*-type regions and the source electrode. The field due to V_G controls the size of the space-charge region in the *n* material. The I_D/V_D characteristics, with V_G as parameter, are similar to the anode characteristics of a pentode. The transistor will operate at frequencies up to 50 Mc/s, has an input impedance of the order of 10 MΩ between gate and source, and may give power gains of 10^4 or more with an I_D/V_G transconductance of several mA/V. At low power levels the operation is not as efficient as that of the junction-type transistor.

621.314.7 **3428**

High-Frequency Germanium Point-Contact Transistor.—(*Engineer, Lond.*, 13th May 1955, Vol. 199, No. 5181, pp. 680–681.) Rapid response is obtained in the Type-EWSI transistor by using a gap of only 0·001 in. between emitter and collector contacts. For an input-waveform rise time of 0·05 μs, the output-waveform rise time is $<$ 0·15 μs.

621.314.7 : 546.28 **3429**

Silicon *n-p-n* Grown-Junction Transistors.—M. Tanenbaum, L. B. Valdes, E. Buehler & N. B. Hannay. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 686–692.) The technique of producing regions of different conductivity type by controlling the rate of growth of a crystal is applied to Si with suitable amounts of Sb and Ga added. Photographs of etched crystals illustrate how the nature of the layer formation is affected by rotation of the crystal during growth, and by heat treatment. The *p*-type regions, which constitute the base of the transistors, are 0·0005–0·002 in. thick. Contacts to the base are made by alloying an Al wire. Characteristics of the transistors are reported; alpha values $>$ 0·9 at −1 mA emitter current have been obtained. Alpha cut-off occurs at about 5 Mc/s for a base-layer thickness about 0·0005 in. Transistors measuring about 0·04 × 0·04 × 0·5 in. have been operated at power levels $>$ 1·5 W with no special cooling arrangements.

621.314.7 : 621.318.57 **3430**

Design of Alloyed-Junction Germanium Transistors for High-Speed Switching.—J. J. Ebers & S. L. Miller. (*Bell. Syst. tech. J.*, July 1955, Vol. 34, No. 4, pp. 761–781.) The interdependence of transistor parameters is discussed. Requirements for high-frequency operation conflict with those for high-voltage operation. Owing to differences in the avalanche multiplication effect, the superiority of the *n-p-n* transistor over the *p-n-p* type for high-speed and high-voltage switching is greater than would be expected from mobility considerations. The theory is illustrated by typical detailed designs.

621.314.7 : 681.142 **3431**

A Transistor Digital Fast Multiplier with Magnetostrictive Storage.—Chaplin, Hayes & Owens. (See 3170.)

621.383.27 **3432**

Some Remarks as to Dark Current and Pulse-Height Distribution in E.M.I. 6260 Photomultipliers.—I. Pelchowitch. (*Rev. sci. Instrum.*, May 1955, Vol. 26, No. 5, pp. 470–474.) Experimental results indicate that the dark current has a multi-electron emission component the major part of which can be attributed to the K^{40} content of the glass. Pulse-height distributions are dependent on the focusing characteristics and broaden when space-charge limitation occurs.

621.385 : 537.533 **3433**

Generalizations of Brillouin Flow.—L. R. Walker. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 780–781.) A brief note presenting analysis for an electron beam in a uniform direct magnetic field.

621.385 : 621.318.57 **3434**

The Magnetron Beam-Switching Tube. Its Operation and Circuit Design Criteria.—S. P. Fan. (*J. Brit. Instn Radio Engrs*, July 1955, Vol. 15, No. 7, pp. 335–354.) Discussion of a switching valve developed from the trochotron and having ten identical sections arranged round a cathode to form a cylindrical structure. Each section comprises a beam-forming and holding electrode ('spade'), a control element (switching grid), and a target serving as output electrode. Stable and astable modes of operation can be combined for switching applications. The characteristics are compared with those of other counting devices.

621.385 + 621.372.57] : 621.396.822 **3435**

The Noise Figure of Linear Quadripoles and Amplifier Valves.—H. W. König. (*Frequenz*, April 1955, Vol. 9, No. 4, pp. 101–109.) Analysis is based on the concept that the noise is generated by two sources, one shunted across the input and the other in series with the input; the former corresponds to induced grid noise and the latter to anode circuit noise. The noise factor is a quadratic function of the complex input admittance and can be determined from four parameters accessible to measurement. The effect of feedback is examined with reference to some particular circuits.

621.385.029.6 **3436**

The Practicality of E-Type Traveling-Wave Devices.—H. Heffner & D. A. Watkins. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 1007–1008.) Microwave valves with a beam traversing a transverse electric field are discussed. When the beam follows a circular path, as in the 'magnetless magnetron' described by Versnel & Jonker (2149 of July), the requirements for satisfactory focusing and r.f. interaction may be incompatible. A system using a spiral beam interacting with a backward wave on a spiral structure could have a conversion efficiency approaching that obtained with a magnetically produced transverse field.

621.385.029.6 **3437**

Reduction of Plasma Frequency in Electron Beams by Helices and Drift Tubes.—G. M. Branch. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, p. 1018.) Analysis indicates that the reduction of the frequency of the space-charge waves in the beam due to the finite beam diameter is much greater than that due to the presence of the drift tube or helix. For a travelling-wave valve under normal conditions there is a difference $< 10\%$ between the frequency with a helix diameter about twice that of the beam and with the same beam in free space.

621.385.029.6 : 517.9 **3438**

An Electromagnetic Difference-Equation of Importance in the Theory of Traveling-Wave Tubes.—H. Derfler. (*Z. angew. Math. Phys.*, 25th March 1955, Vol. 6, No. 2, pp. 104–114. In English.) A second-order difference equation is discussed expressing the currents and voltages in a chain of 6-pole networks. This equation is shown to apply to interactions occurring in travelling-wave valves with space-periodic structure. The theory affords a method of calculating important valve parameters explicitly.

621.385.029.6 : 621.372 **3439**

Electromagnetic Wave Propagation on Helical Conductors imbedded in Dielectric Medium.—S. Olving. (*Chalmers tek. Högsk. Handl.*, 1955, No. 156, 14 pp. In English.) Analysis for propagation along a helix embedded in the wall of a dielectric tube shows that the optimum effect on the phase velocity is obtained when the tube inner diameter is equal to the helix diameter. More power is required to reduce the phase velocity by use of the dielectric than by decreasing the helix pitch angle, hence this device should only be used in electron-beam valves where a reduction in coupling between beam and helix can be tolerated in order to obtain a low axial velocity.

621.385.029.6 : 621.373.4 : 621.396.822 **3440**

1954 Symposium on Fluctuation Phenomena in Microwave Sources.—(*Trans. Inst. Radio Engrs*, Dec. 1954, Vol. ED-1, No. 4, pp. 1–280.) Includes 27 papers or abstracts dealing with noise and noise measurements in magnetrons, klystrons, travelling-wave valves and other microwave oscillators.

621.385.029.6 : 621.376.32 : 621.318.134 **3441**

Magnetic Tuning of Klystron Cavities.—J. C. Cacheris, G. Jones & L. Diehl. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, p. 1017.) Wide-band f.m. can be achieved without introducing appreciable a.m. by applying a magnetic field to a ferrite in the external cavity resonator of an X-band klystron.

621.385.029.6 : 621.396.822 **3442**

The Minimum Noise Figure of Microwave Beam Amplifiers.—H. A. Haus & F. N. H. Robinson. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 981–991. Correction, *ibid.*, Sept. 1955, Vol. 43, No. 9, p. 1101.) Using matrix analysis and the transmission-line analogy, it is shown that any microwave long-beam amplifier valve with loss-free structures has a noise figure at least as great as that of a conventional travelling-wave valve. The noise figure is entirely determined by the noise parameters of the beam which in turn depend only on conditions in the immediate neighbourhood of the cathode. The noise figure is greater when lossy structures are used. See also 3123 of October (Haus).

621.385.029.64 **3443**

Reflex Klystrons for Microwave Radio Relay Systems.—E. D. Reed. (*Bell Lab. Rec.*, May 1955, Vol. 33, No. 5, pp. 173–177.) A simple exposition is given of the principles of operation of reflex klystrons and two laboratory prototypes are described. These are the Type-431A transmitting oscillator for the 3·7–4·2 kMc/s frequency range and the Type-419A f.m. deviator for the 3·9–4·4 kMc/s range.

621.385.13 : 621.373.029.64 : 537.5 **3444**

High-Frequency Plasma-Electron Oscillations.—K. G. Emeleus & R. A. Bailey. (*Brit. J. appl. Phys.*, April 1955, Vol. 6, No. 4, pp. 127–128.) E.m. oscillations of a frequency of the order of 10 kMc/s were produced in two hot-filament tubes filled with Ar at pressures of about $1{\cdot}22 \times 10^{-1}$ and 7×10^{-2} mm Hg, respectively. Frequency decreased with a decrease in pressure as predicted by theory. The output power was of the order of a microwatt. See also 495 of 1950 (Armstrong & Emeleus).

621.385.2 **3445**

Potential Distribution as a Function of Current in the Spherical Diode.—A. Dunkuls & E. Zwicker. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, p. 779.) Values of mathematical functions involved in the calculation, using the method developed by Copeland & Eggenberger (2382 of 1952), are tabulated.

621.385.2 **3446**

Electron Transit Time in a Planar Diode with Space Charge.—H. Paucksch. (*Arch. elekt. Übertragung*, April 1955, Vol. 9, No. 4, pp. 171–176.) Potential-minimum conditions and a Maxwellian distribution of initial electron velocities are assumed. A formula for the transit time is derived in terms of an integral function of the normalized initial position and velocity. Values of this function are tabulated both for electrons reaching the anode and those returning to the cathode. For fringe areas formulae of corresponding accuracy can be given.

621.385.2 : 621.316.722.1 **3447**

Saturated Diodes.—F. A. Benson & M. S. Seaman. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 360–365.) The characteristics of several types of saturated diode for use as controlling elements in voltage-stabilizer circuits are presented and compared with those of the Type-29C1 diode noted earlier (595 of 1954).

621.385.2 : 621.376.232.2 **3448**

Microwave Detection in a Thermionic Diode.—P. A. Redhead. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 995–1000.) Theoretical analysis is presented assuming a parabolic distribution of potential and taking account of both static and microwave fields. Within certain operational limits which are determined the diode behaves as a v.m. detector.

621.385.3.01 **3449**

Theory of Transmitting Triode with Finite Electron Transit Time.—F. Hülster. (*Arch. elekt. Übertragung*, May 1955, Vol. 9, No. 5, pp. 207–220.) Theory presented by Gundlach (998 of 1949) is discussed and extended to take account of the convection current. A graphical method is described for investigating conditions in the cathode/grid space; consideration is confined to Class-B operation, and a sinusoidal control voltage is assumed. Conditions in the grid/anode space are hence determined. The theory is applied to consideration of a Type-LD90 triode for operation in the 10-cm waveband.

621.385.4 **3450**

Amplification Factors and Mutual Conductance of a Beam Power Valve.—S. Deb. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 469–474.) An analysis is made of the field distribution in a valve with control-grid pitch greater than distance between cathode and control grid. Expressions are derived for the various amplification factors; in general these factors vary along the surface of the cathode. By taking account of the corresponding 'island' formation, values are computed for the mutual conductance in good agreement with experimentally obtained characteristics.

621.385.42 **3451**

Improved V.H.F. Double-Tetrode Transmitting Valves.—(*Engineer, Lond.*, 15th April 1955, Vol. 199, No. 5177, pp. 522–523.) Details are given of the construction of valves with low lead inductance for use at frequencies up to 600 Mc/s. Neutralizing capacitors in the form of short wires connected to the grid supports are incorporated. The top and base of the envelope are of sintered glass; the anode seals are pre-formed, thus facilitating precise location of the anodes. The latter are of Mo coated with powdered Zr to reduce secondary emission, improve heat radiation and act as getter.

621.385.832 **3452**

A Cathode-Ray Tube for Symmetrical and Asymmetrical Deflection.—K. Schwalgin. (*Elektronik*, April 1955, Vol. 4, No. 4, pp. 82–84.) Trapezoidal distortion in asymmetrical operation is avoided in the c.r. tube Type-DG7-12C by means of specially curved deflection plates. Photographs of these are shown.

621.385.832 **3453**

Some Half-Tone Charge-Storage Tubes.—R. S. Webley, H. G. Lubszynski & J. A. Lodge. (*Proc. Instn elect. Engrs*, Part B, July 1955, Vol. 102, No. 4, pp. 401–411.) "Four tubes are described which have been developed for use primarily in bright radar display systems. Two of the tubes are full-storage television camera tubes in which sufficient charge is stored to enable many reading scans to be performed before the charge is consumed. In the other two tubes a charge pattern is used to modulate an electron beam, the charge pattern itself remaining unchanged in the process. In the two former tubes and in one of the latter, the information to be stored must be supplied in the form of an optical image. In the fourth tube it must be supplied as an electrical signal. Continuous reading times ranging from a few seconds to several hours have been achieved. Resolutions of up to 700 spots per picture diameter are also reported. With some of the tubes, the erasure rates are readily controllable over a wide range."

621.385.832 **3454**

The Radechon, a Barrier-Grid Storage Tube.—A. S. Jensen. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 197–215.) A simplified version of the tube described by Jensen et al. (2986 of 1948) has been developed for applications requiring only a few reproductions of the signal; it provides random access and about 30 intensity levels. Construction and characteristics are described.

621.385.832 **3455**

Discharging an Insulator Surface by Secondary Emission without Redistribution.—A. S. Jensen. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 216–233.) Analysis relevant to the operation of the radechon (3454 above) is presented.

621.385.832 : 621.317.729 **3456**

Trajectory-Tracer Study of Helix- and Band-Type Post-Deflection Acceleration.—G. C. Sponsler. (*J. appl. Phys.*, June 1955, Vol. 26, No. 6, pp. 676–682.) Reductions of deflection sensitivity and linearity produced by c.r.-tube post-deflection accelerating systems comprising (*a*) a continuous helix and (*b*) a series of bands are compared, using an automatic trajectory tracer similar to that described by Sander et al. (2852 of 1952) but operating faster. The continuous helix was found to be far better as regards sensitivity and slightly better as regards linearity.

621.385.832 : 621.318.57 **3457**

Radechon Storage Tube Circuits.—A. S. Jensen & G. W. Gray. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 234–241.) Circuit methods devised to keep the low-level output (reading) signal separate from the high-level writing or switching signals on the signal plate are discussed. See 3454 above.

621.385.832 : 621.39 **3458**

A Time-Sampling and Amplitude-Quantizing Tube.—R. P. Stone, C. W. Mueller & W. M. Webster. (*Proc. Inst. Radio Engrs*, Aug. 1955, Vol. 43, No. 8, pp. 960–966.) A transmission system is discussed in which two signals, e.g. video signals, are accommodated in a bandwidth normally occupied by one of them; this is achieved by quantizing one of the signals and adding it to the other, previously attenuated so that its amplitude never exceeds one quantum step. The ribbon-beam c.r. tube used for the quantizing has one set of deflection plates to which a sampling signal of frequency e.g. 5 Mc/s is applied, a sampling slit, and a second set of deflection plates to which the transmission signal is applied, a 1-μs sawtooth voltage being used in the tests reported. The target has a stepped aperture for effecting the quantization, together with a set of triangular apertures enabling the process to be reversed at the receiver. The anode voltage is 300 V and the maximum beam current is only 55 μA; the signal/noise ratio is computed to be 55 db.

621.385.832 : [621.396.96 + 621.317.755 **3459**

A Scanning-Coil for an Off-Centre P.P.I. Display.—G. W. Harvey. (*Electronic Engng*, Aug. 1955, Vol. 27, No. 330, pp. 338–342.)

621.387 : 681.142 **3460**

The Cold-Cathode Gas Diode.—(See 3174.)

MISCELLANEOUS

061.6 : 621.396 **3461**

Radio Research Station, Ditton Park, Bucks.—R. L. Smith-Rose. (*Nature, Lond.*, 28th May 1955, Vol. 175, No. 4465, pp. 921–923.) A brief account of the organization and program.

621.3 **3462**

Components and Materials for Electronic Equipment.—(*Onde élect.*, March/April 1955, Vol. 35, Nos. 336/337, pp. 181–423.) The issue contains 25 papers dealing with resistors, capacitors, crystal valves, magnetic materials, etc. Some of these are abstracted individually above.

001.891 : 621.396 **3463**

Radio Research 1954. [Book Review]—Publishers: H.M. Stationery Office, London, 1955, 47 pp., 2s. 6d. (*Engineering, Lond.*, 3rd June 1955, Vol. 179, No. 4662, p. 698.) Annual report of the Chairman of the Radio Research Board and of the Director of Radio Research.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Organization of the Department of Scientific and Industrial Research and published by arrangement with that Department.

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of journal titles conform generally with the style of the World List of Scientific Periodicals. An Author and Subject Index to the abstracts is published annually; it includes a selected list of journals abstracted, the abbreviations of their titles and their publishers' addresses.

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ACOUSTICS AND AUDIO FREQUENCIES

534.2 + [538.566 : 535.43 3464

On the Scattering of Spherical Waves by a Cylindrical Object.—Wait. (See 3582.)

534.2 3465

Sound Scattering and Transmission by Thin Elastic Rectangular Plates.—J. Martinek & G. C. K. Yeh. (*Quart. J. Mech. appl. Math.*, June 1955, Vol. 8, Part 2, pp. 179–190.) Analysis is given for the case where the plate separates two fluid media and is excited to forced vibrations by the incident wave. The pressure in the scattered and transmitted waves is determined in terms of the characteristic parameters of the plate and of the two media.

534.2 3466

The Attenuation of Sound in a Turbulent Atmosphere over a Desert Terrain.—M. Mokhtar & M. A. Mahrous. (*Acustica*, 1955, Vol. 5, No. 3, pp. 179–181.)

534.213.4 3467

Attenuation of the (1, 0) and (2, 0) Modes in Rectangular Ducts.—A. M. Ghabrial. (*Acustica*, 1955, Vol. 5, No. 3, pp. 187–192.) Report of an experimental investigation using sound in the frequency range 1·18—3·4 kc/s. The values found for the attenuation constants are in agreement with values deduced from Beatty's theory (1045 of 1951).

534.23-14-8 3468

Sound Absorption in Liquids in Relation to their Specific Heats.—S. Parthasarathy & D. S. Guruswamy. (*Ann. Phys., Lpz.*, 15th June 1955, Vol. 16, Nos. 1/2, pp. 31–42. In English.) A formula is derived relating the absorption to the specific heats for a frequency of 3 Mc/s.

534.232 3469

Directivity and Mechanical-Impedance Characteristics of Cylindrical Acoustic Sources.—M. Federici. (*Ricerca sci.*, June 1955, Vol. 25, No. 6, pp. 1423–1430.) Analysis is given for a cylinder executing radial vibrations. The directivity characteristic is expressed as the product of a trigonometric function of cylinder height and a Bessel function of the radius. For cylinders long with respect to λ the mechanical impedance is expressed as the ratio between two Bessel functions of the radius. Results are shown graphically.

534.232-8 : 621.318.134 3470

Use of Ferrites in Ultrasonic Generators.—U. Enz. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st June 1955, Vol. 33, No. 6, pp. 209–212. In German.) The suitability of various ferrites as magnetostrictive generators is discussed in relation to measurements of their magnetic properties. Generators of various shapes are illustrated; the highest efficiency attained is 94%. A radiated output as high as 1 kW/cm² is attainable in theory; in practice limitations arise due to the inadequate mechanical strength of the ferrite and other causes. The strength can be increased by addition of PbO during preparation, or by pre-stressing. Possible applications are discussed.

534.3/.4 3471

The Physical Structure of the Musical Signal.—A. Moles. (*Rev. sci., Paris*, July–Dec. 1953, Vol. 91, No. 3324, pp. 277–303.)

534.32 : 621.395.625 3472

The Subjective Discrimination of Pitch and Amplitude Fluctuations in Recording Systems.—A. Stott & P. E. Axon. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 643–656.) Technique and equipment developed by the B.B.C. are described for making controlled tests of the threshold of perception of pitch and amplitude fluctuations, using musical or other programme signals. The results enable frequency weighting characteristics to be defined which can be incorporated into instruments for measuring the magnitude of unwanted fluctuations in any kind of recording equipment.

534.613 3473

Use of a Bifilar Device as a Balance for measuring Acoustic Radiation Pressure.—G. Laville. (*C. R. Acad. Sci., Paris*, 1st Aug. 1955, Vol. 241, No. 5, pp. 465–467.)

534.84 : 534.6 **3474**

Measurements of the Reflection of Flexural Waves at Sudden Changes of Cross-Section of Rods.—Mugiono. (*Acustica*, 1955, Vol. 5, No. 3, pp. 182–186. In German.) Report of a theoretical and practical investigation relevant to the propagation of flexural waves in building structures.

534.844 **3475**

Normal Modes and Reverberation.—N. B. Bhatt. (*J. Instn Telecommun. Engrs, India*, June 1955, Vol. 1, No. 2, pp. 61–68.) Analysis is presented for reverberation in rooms with nonuniform distribution of absorption over the walls. For a room with one absorbing wall and the other walls perfectly reflecting, there exist two reverberation times corresponding respectively to sound propagated normal to and parallel to the absorbing wall, giving rise to a discontinuity in the decay characteristic.

534.86 : 621.396.712.3 : 621.395.625.3 **3476**

Artificial Reverberation.—P. E. Axon, C. L. S. Gilford & D. E. L. Shorter. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 624–640. Discussion, pp. 640–642.) The characteristics of artificial-reverberation apparatus using delay channels with overall feedback are discussed and illustrated by the results of early experiments with acoustic-delay tubes. Details are given of a magnetic-recording delay system used by the B.B.C.; the effective number of delay paths is greatly increased by use of a double recording track. Flutter effects associated with impulsive signals are reduced by use of a small auxiliary reverberation chamber.

621.395.616 **3477**

Stable Laboratory-Standard Capacitor Microphone.—J. F. Houdek, Jr. (*Elect. Commun.*, June 1955, Vol. 32, No. 2, pp. 75–81; *J. audio Engng Soc.*, Oct. 1954, Vol. 2, No. 4, pp. 234–238.) A detailed description is given of a precision microphone of rugged construction, with a spring-loaded rear-electrode assembly, providing constant diaphragm tension.

621.395.616 **3478**

The Electrostatic Microphone.—(*TSF et TV*, July/Aug. 1955, Vol. 31, Nos. 321/322, pp. 194–197.) Description of the French Type-515C high-quality capacitor microphone.

621.395.625.3 : 771.53 **3479**

Recent Developments in Magnetic Striping by the Lamination Process.—R. F. Dubbe. (*J. Soc. Mot. Pict. Telev. Engrs*, July 1955, Vol. 64, No. 7, pp. 378–379.) Commercial equipment suitable for 8-mm and 16-mm films and operating at film speeds up to 125 ft/min is briefly described.

AERIALS AND TRANSMISSION LINES

621.315.21 : 621.372.2 **3480**

Scattering of Electrical Waves in Slightly Nonuniform Transmission Lines.—M. Didlaukis. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 269–271.) The form of the correlation function of the random deviations of the characteristic impedance is discussed and a Fourier-transformation method is developed for deducing the function from the measurable spectrum of the mean-square deviations of the input impedance.

621.315.212.1 : 621.372.21 **3481**

Comparative Study of Pulse Echoes due to Irregularities in Coaxial Cables.—G. Comte, F. de Carfort & A. Ponthus. (*Câbles & Transm.*, July 1955, Vol. 9, No. 3, pp. 202–227.) An expression is given for the waveforms of echoes caused by sudden and by gradual impedance changes along the line. Testing equipment and typical test results are discussed; the importance of the test-pulse shape is indicated.

621.315.28 : 621.395.44 **3482**

A Transatlantic Telephone Cable.—M. J. Kelly, G. Radley, G. W. Gilman & R. J. Halsey. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 717–719.) Discussion on 1547 of June.

621.372 : 621.317.336 **3483**

Transmission-Line Termination.—J. M. C. Dukes. (*Wireless Engr*, Oct. 1955, Vol. 32, No. 10, pp. 266–271.) The concepts presented previously (1255 of May) are extended and applied to the determination of the impedance of a line termination when measured through a mismatched junction between two dissimilar transmission lines.

621.372.8 + 621.372.413 **3484**

Theory of Imperfect Waveguides: the Effect of Wall Impedance.—A. E. Karbowiak. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 698–708.) Analysis shows that although with circular waveguides all E and H modes are stable, with rectangular guides all E modes and higher-order H modes are unstable, only H_0 modes propagating without change of form. Formulae are derived for calculating the propagation coefficients of waveguides with wall impedance and the bandwidth and resonance frequency of cavities with wall impedance.

621.372.8 **3485**

Irregular Waveguides with Slowly Varying Parameters.—B. Z. Katsenelenbaum. (*C. R. Acad. Sci. U.R.S.S.*, 1st June 1955, Vol. 102, No. 4, pp. 711–714. In Russian.) The irregular waveguide is considered as a stepped waveguide made up of short sections of regular waveguides of different constant cross-sections. The coefficients of the functions describing the field are connected by a system of linear differential equations of the first order. A method of solving the problem is developed for the simple case when H waves only are propagated, as in a conical junction in a circular waveguide.

621.372.8 **3486**

On the Theory of Disc-Loaded Waveguide.—H. Derfler. (*Z. angew. Math. Phys.*, 25th May 1955, Vol. 6, No. 3, pp. 190–206. In English.) Theory based on the difference equation discussed previously (3438 of November) is presented.

621.372.8 **3487**

Note on the Properties of Two Functions appearing in the Theory of TM Wave Propagation through Periodically Iris-Loaded Guides.—C. C. Grosjean. (*Nuovo Cim.*, 1st June 1955, Vol. 1, No. 6, pp. 1264–1266. In English.) Functions introduced previously (2832 of October) are discussed in detail.

621.372.8(083.74) **3488**

I.R.E. Standards on Antennas and Waveguides: Definitions for Waveguide Components, 1955.—(*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1073–1074.) Standard 55 I.R.E. 2.S1.

621.372.8 : 621.318.134 **3489**

Unusual Waveguide Characteristics associated with the Apparent Negative Permeability obtainable in Ferrites.—G. H. B. Thompson. (*Nature, Lond.*, 25th June 1955, Vol. 175, No. 4469, pp. 1135–1136.) With the ferrite magnetized in the same direction as that in which a right-handed circularly polarized plane wave of frequency 10 kMc/s is propagated, the effective permeability associated with the transverse field components may be negative, the wave then being evanescent. In a waveguide, this effect occurs for guide dimensions above a critical value; below this value the wave is propagated, but with negative group velocity. Experimental results are shown graphically for two circular waveguides with diameters respectively above and below the critical value.

621.372.8 : 621.318.134 : 538.6 **3490**

Figure of Merit for Microwave Ferrites at Low and High Frequencies.—B. Lax. (*J. appl. Phys.*, July 1955, Vol. 26, No. 7, p. 919.) The figure of merit for Faraday rotators comprising waveguides containing ferrites is defined as the ratio of rotation to attenuation and is equal to ωT, where T is the relaxation time constant of the ferrite. Theoretical estimates are made of losses at frequencies below about 3 kMc/s, and the figure of merit and low-frequency limits of operation are hence deduced. For a device with an insertion loss of 0·5 db this limit is about 1 kMc/s, and for a 1-db insertion loss about 500 Mc/s. At 9 kMc/s the figure of merit of 120 for single crystals may define the upper limit.

621.396.67 **3491**

Multipoles and Schelkunoff Waves. The General Case.—I. Ferrari. (*R.C. Accad. naz. Lincei*, June 1955, Vol. 18, No. 6, pp. 623–630.) The analysis presented previously (27 of January and 2838 of October) is extended to deal with systems with more marked asymmetry.

621.396.67 : 621.317.3 **3492**

Measurements on Receiving Aerials: Part 1.—I. Grosskopf. (*Arch. tech. Messen*, June 1955, No. 233, pp. 121–124.)

621.396.67 : 621.396.712 **3493**

F.M. Antenna Inside the A.M. Tower.—M. W. Scheldorf & G. Klink, Jr. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 130–131.) A note describing the aerial arrangements at station WTOP.

621.396.67 : 621.396.81 **3494**

The Limits of Communication Reception using Aerials with Losses.—M. Didlaukis. (*Fernmeldetech. Z.*, July 1955, Vol. 8, No. 7, pp. 384–386.) An evaluation is made of the lowest value of field strength capable of being received in some telegraphy and d.f. systems.

621.396.674.3 : 621.397.6 **3495**

V.H.F. Aerials for Television Broadcasting.—G. J. Phillips. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 687–688.) Aerials have been designed by the B.B.C. using batwing elements in conjunction with masts of thickness comparable with λ; arrangements suitable for (*a*) horizontal and (*b*) vertical polarization are described, for bands I and III. Aerials using systems split into an upper and lower half are also mentioned; the two halves are fed separately, thus avoiding the need for a reserve aerial.

621.396.677.3.029.63 **3496**

Metal-Foil 'Fir-Tree' Aerial [dipole array] **for Decimetre Wavelengths.**—H. Schneider. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 312–315.) Microstrip construction is used, the dipoles, feeders and reflectors being of copper foil stuck between two insulating sheets. For an array area 120 × 90 cm including 144 dipoles, half-power beam widths of 6° and 9° have been obtained at 13·6 cm λ. Dipole arrays produced by such methods may be economically comparable with mirror- and lens-type aerials.

621.396.677.43 **3497**

Radiation Resistance and Gain of Rhombic Aerials, with Damping due to Radiation taken into Account Approximately.—H. Zuhrt. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 255–258.) The formulae derived are sufficiently accurate for most practical applications. Design curves are also given.

621.396.677.85 **3498**

Dielectric Lens for Microwaves.—K. S. Kelleher & C. Goatley. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 142–145.) By varying the size and spacing of holes in laminated disks of dielectric material, a controlled variation of refractive index is obtained across the lens thus built up.

AUTOMATIC COMPUTERS

681.142 **3499**

High - Speed Electronic - Analogue Computing Techniques.—D. M. MacKay. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 609–620. Discussion, pp. 620–623.) An investigation has been made of the upper limits of speed conveniently attainable in various basic operations performed with a particular differential analyser. With multidimensional displays and electronic programming a very large increase in information capacity is attainable in problems requiring systematic search processes for their solution.

681.142 **3500**

A Mercury Delay Line Storage Unit.—R. D. Ryan. (*J. Brit. Instn Radio Engrs*, Aug. 1955, Vol. 15, No. 8, pp. 419–427.) Reprint. See 2578 of 1954.

681.142 **3501**

Magnetic Memory Device for Business Machines.—S. J. Begun. (*Elect. Engng, N.Y.*, June 1955, Vol. 74, No. 6, pp. 466–468.) Description of a device combining the short access time of a magnetic drum and the large storage capacity of the tape record.

681.142 **3502**

Synchronizing Magnetic Drum Storage Speed.—E. W. Bivans. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 140–141.) Synchronization to an acoustic delay line is obtained by a time-difference discriminator which controls the drum speed. An accuracy within $\pm 0{\cdot}5\ \mu s$ is achieved with a 10% line-voltage variation.

681.142 **3503**

Square-Law Circuit.—K. S. Lion & R. H. Davis. (*Electronics*, Sept. 1955, Vol. 28, No. 9, pp. 192..202.) A device for use as a multiplier in analogue computers consists of a source producing a negative-going triangular waveform which is superposed on a positive-going input signal applied to a diode. The average value of the output voltage is proportional to the square of the input voltage.

681.142 : 621.383.2 **3504**

Photoelectric Transformation of Mathematical Functions. Solution of Equations.—G. Blet. (*Bull. Soc. franç. Élect.*, June 1955, Vol. 5, No. 54, pp. 341–344.) An arrangement comprising a mirror galvanometer in combination with an appropriately shaped diaphragm and a photocell is used to generate a current $f(x)$ when the current x flows through the galvanometer. Elaboration of the arrangement to generate complex functions is discussed.

681.142 : 621.385.5 **3505**

Binary Adder Tube for High-Speed Computers.—Maynard. (See 3805.)

CIRCUITS AND CIRCUIT ELEMENTS

621.3 : 061.4 **3506**

Interesting New Developments in the Components Industry at the Hanover Exhibition.—(*Funk-Technik, Berlin*, June 1955, Vol. 10, No. 11, pp. 294–297.)

621.314.22.011.23 **3507**

Stray Reactances in Power and Instrument Transformers.—W. Knaack. (*Electrotech. u. Maschinenb.*, 15th June & 1st July 1955, Vol. 72, Nos. 12 & 13, pp. 269–279 & 291–298.)

621.318.435 : 621.373.443 **3508**

Saturating Reactor Magnetic Pulser Design.—E. M. Williams & R. A. Mathias. (*Elect. Engng. N.Y.*, June 1955, Vol. 74, No. 6, p. 525.) Digest of paper to be published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1955, Vol. 74, pp. 185–207. See also 2362 of 1951 (Melville).

621.318.57 : 621.3.042 **3509**

The Transfluxor—a Magnetic Gate with Stored Variable Setting.—J. A. Rajchman & A. W. Lo. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 303–311.) The transfluxor is a device comprising a magnetic core with two or more apertures, the core material having a nearly rectangular hysteresis loop. Switching and storage operations are performed by controlled transfer of the flux from leg to leg of the core. The operation of a two-aperture device is described in detail.

621.318.57 : 621.374.3 : 621.314.7 **3510**

[Junction-] **Transistor Binary-Number Store for Pulse Operations.**—E. Munk & P. Batz. (*Fernmeldetech. Z.*, July 1955, Vol. 8, No. 7, pp. 379–381.)

621.318.57 : 621.374.32 **3511**

The Design of Hard-Valve Binary Counters.—D. M. Taub. (*Electronic Engng*, Sept. 1955, Vol. 27, No. 331, pp. 386–392.) The method of design takes account of tolerances on component values, valve characteristics and supply voltages, and indicates modifications necessary when Se diodes are used in place of hot-cathode diodes for interstage coupling; it is valid at counting speeds up to several kc/s.

621.37 **3512**

The Relation between Standing-Wave Ratio and Bandwidth in Wide-Band Compensation of a Reactance.—R. Merten. (*Fernmeldetech. Z.*, July 1955, Vol. 8, No. 7, pp. 387–393.) Calculations are made for two different equivalent circuits representing a resistance accompanied by inherent reactance. The s.w.r. obtained when the compensated resistance is connected to a loss-free line with purely resistive characteristic impedance is used as a criterion of the compensation. The results are expressed as irrational algebraic functions which are presented as bandwidth curves. Simple relations are derived between the permissible s.w.r. and the bandwidth.

621.37 : 621.318.57 **3513**

The Folded Tree.—A. W. Burks, R. McNaughton, C. H. Pollmar, D. W. Warren & J. B. Wright. (*J. Franklin Inst.*, July & Aug. 1955, Vol. 260, Nos. 1 & 2, pp. 9–24 & 115–126.) The problem of constructing circuits to perform certain functions, such as switching functions, is treated by representing the circuits by 'vertex diagrams', of which the 'folded tree' is a particular form.

621.372.029.64 : 538.569.4 **3514**

Revolutionary New Oscillator-Amplifier.—Shunaman. (See 3583.)

621.372.412 : 549.514.51 **3515**

Effects of Impurities on Resonator Properties of Quartz.—A. R. Chi, D. L. Hammond & E. A. Gerber. (*Proc. Inst Radio Engrs*, Sept. 1955, Vol. 43, No. 9, p. 1137.)

621.372.412 : 621.314.7 **3516**

Calculation of the Oscillation Frequency of a Quartz Crystal maintained by a Transistor.—G. Briffod. (*C. R. Acad. Sci., Paris*, 11th July & 1st Aug. 1955, Vol. 241, Nos. 2 & 5, pp. 159–161 & 458–459.) The calculation presented previously (1895 of July) is extended to the general case where it is required to determine both the influence of the maintaining system on the frequency and the possibility of aligning this frequency with a given reference frequency. Formulae are derived based on the use of capacitors in series and in parallel with the crystal.

621.372.413 + 621.372.8 **3517**

Theory of Imperfect Waveguides: the Effect of Wall Impedance.—Karbowiak. (See 3484.)

621.372.413 **3518**

Wide-Range Electronic Tuning of Microwave Cavities.—F. R. Arams & H. K. Jenny. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1102–1110.) Analysis is presented for tuning by introducing into the cavity an electron beam with its direction parallel to the magnetic field, so that spiralling of the beam is produced. Measurements are reported indicating that the tuning range is much greater for a cavity containing a gas at low pressure than for an evacuated cavity.

621.372.44 **3519**

Series Resonance with Nonlinear Capacitor.—J. C. Hoffmann. (*C. R. Acad. Sci., Paris*, 11th July 1955, Vol. 241, No. 2, pp. 180–182.) A graphical method is used to explain multiple resonance and hysteresis in a circuit tuned by a capacitor with a $BaTiO_3$ dielectric.

621.372.5 **3520**

Unambiguous Choice of Arrow Direction for Currents and Voltages in Quadripoles with Applications to Directional Quadripoles and Gyrators.—M. J. O. Strutt. (*Arch. Elektrotech.*, 20th June 1955, Vol. 42, No. 1, pp. 1–5.) It is recommended that the positive direction of the voltage arrow should always point from positive to negative charge; with quadripole diagrams, the output-current arrow should point away from the quadripole. Simplifications of network analysis resulting from adoption of this convention are indicated.

621.372.5 **3521**

Conditions for Aperiodicity in Linear Systems.—A. T. Fuller. (*Brit. J. appl. Phys.*, June 1955, Vol. 6, No. 6, pp. 195–198.) The necessary and sufficient conditions are derived; when expressed in terms of the coefficients of the characteristic equation they take the form of a number of simple determinantal inequalities which are closely analogous to the Routh-Hurwitz stability criteria.

621.372.5 **3522**

Definition of the Ideal Transformer and the Ideal Gyrator by their Impedance-Transforming Properties.—F. A. Fischer. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 309–311.) The fundamental difference between the two networks is that the input impedance of the ideal transformer is directly proportional to the load impedance, while for the ideal gyrator the proportionality is inverse. The ideal gyrator can be completely defined as a passive linear loss-free quadripole with frequency-independent transforming properties.

621.372.5 3523

A New Method for investigating Linear Quadripoles: Part 2.—J. de Buhr. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 335–340.) Continuation of work abstracted in 2864 of October. A distinction is made between elliptic, hyperbolic, parabolic and loxodromic quadripoles.

621.372.5 3524

Two Network Theorems for Analytical Determination of Optimum-Response Physically Realizable Network Characteristics.—S. S. L. Chang. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1128–1135.)

621.372.512.3 : 621.314.7 3525

How to Design I.F. Transistor Transformers.—R. R. Webster. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 156–158, 160.) Design curves are given for single- and double-tuned units providing matching of collector and base impedances while meeting bandwidth and minimum-insertion-loss requirements.

621.372.54 3526

Symmetrical Lattice Filters.—J. Oswald & J. Dubos. (*Câbles & Transm.*, July 1955, Vol. 9, No. 3, pp. 177–201.) The calculation and field of utility of standard types of lattice filter are discussed and permissible approximations are indicated. Classification based on image parameters is proposed, on the lines of the system used in a previous paper on ladder filters [1710 of 1954 (Oswald)].

621.372.54 3527

Note on Antimetrical Lattice Filters with Successive Reactances of Alternate Sign.—R. Leroy. (*Câbles & Transm.*, July 1955, Vol. 9, No. 3, pp. 246–247.) A simplification of the treatment given by Oswald (64 of January).

621.372.543.3 3528

Notch Network Design.—C. J. Savant, Jr, & C. A. Savant. (*Electronics*, Sept. 1955, Vol. 28, No. 9, p. 172.) Curves are given facilitating the design of bridged-T band-stop filters operating between equal impedances.

621.373 3529

The Period and Amplitude of the van der Pol Limit Cycle.—E. Fisher. (*J. appl. Phys.*, March 1954, Vol. 25, No. 3, pp. 273–274.) "The amplitude and period of the limit cycle of the van der Pol equation, $\ddot{y} + y = \nu\dot{y}(1 - y^2)$, are found for all values of ν by joining graphically the results of solutions about $\nu = 0$ and $\nu = \infty$."

621.373 3530

Limit-Cycle Period of Nonlinear Oscillation.—J. Groszkowski. (*Bull. Acad. polon. Sci.*, Classe 4, 1955, Vol. 3, No. 2, pp. 85–91. In English.) The problem is discussed with reference to previous work on the solution of the van der Pol equation $\ddot{x} + \nu(1 - x^2)\dot{x} + x = 0$. A formula is derived for the limit-cycle period which is applicable both for small and large values of ν, corresponding respectively to quasi-sinusoidal and relaxation oscillations. Results obtained from various formulae are compared in a table.

621.373.42.029.42 3531

The Design and Performance of a Simple V.L.F. Oscillator.—R. A. Seymour & J. S. Smith. (*Electronic Engng*, Sept. 1955, Vol. 27, No. 331, pp. 380–384.) Using a Wien *RC* network for frequency control, the oscillator covers the range 0·01–100 c/s in finite steps, with a maximum output of 6 V r.m.s. into a 6-kΩ load.

621.373.43 : 621.385.15 3532

Secondary-Emission-Valve Pulse Generator with Cathode Output.—R. Favre. (*Helv. phys. Acta*, 31st May 1955, Vol. 28, Nos. 2/3, pp. 167–171. In French.) A positive-feedback circuit giving a very low output impedance is used, capable of producing pulses of amplitude 50–60 V with rise time about 20 mμs. By using a pentode as cathode load it is possible to obtain a wide variety of pulse waveforms. The arrangement gives a better performance than the ordinary blocking oscillator.

621.373.431.1 : 621.373.44 3533

Investigation of the Time Delay in the Triggering of a Pulse in a Monostable Multivibrator.—G. Haas. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 272–276.) Results of experiments indicate that a monostable multivibrator may be used as a pulse amplifier in applications where waveform distortion is unimportant. With pulse voltages above 100 mV the multivibrator used showed time delays of less than 10^{-8} sec and these were independent of pulse width over a wide range. The gain obtainable is about 500. Time delays in a free-running multivibrator are of the order of 10^{-7} to 10^{-6} sec; this is shown theoretically to be due to the stray capacitances present.

621.373.444 3534

Triggered Microsecond Sweep Generators.—D. P. C. Thackeray. (*Electronic Engng*, Sept. 1955, Vol. 27, No. 331, pp. 397–401.) Hard-valve balanced-output and single-ended sweep generators are described using Miller integrator feedback for linearization; both are capable of providing a 450-V sweep in 1 μs. Applications in high-speed photography are indicated.

621.374.3 : 621.314.7 : 621.318.57 3535

A Time-Delay Device using Transistors.—G. F. Pittman, Jr. (*Elect. Engng, N.Y.*, June 1955, Vol. 74, No. 6, pp. 498–501.) Pulse shaping and counting circuits are described in which junction transistors are used for switching, in conjunction with magnetic cores with rectangular hysteresis loops. The number of pulses required to saturate the core is such that long time delays can be produced. Published also in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, March 1955, Vol. 74, pp. 54–58.

621.374.32 3536

High-Frequency Pulse Counter.—R. Favre. (*Helv. phys. Acta*, 31st May 1955, Vol. 28, Nos. 2/3, pp. 179–184. In French.) A circuit based on the secondary-emission-valve pulse generator described in 3532 above.

621.374.4 : 621.375.3.029.3 : 621.395.2 3537

All-Magnetic Audio Amplifier.—J. J. Suozzi & E. T. Hooper. (*Electronics*, Sept. 1955, Vol. 28, No. 9, pp. 122–125.) Three cascaded magnetic frequency triplers are used to provide a 10·8-kc/s carrier from a 400-c/s line frequency. Used with a carbon microphone and a two-stage magnetic amplifier, the system gives an audio output power of 2·5 W, with linear operation over the range 90–3 000 c/s.

621.374.44 : 621.385.15 3538

Wide-Band Frequency Divider.—R. Favre. (*Helv. phys. Acta.* 31st May 1955, Vol. 28, Nos. 2/3, pp. 172–178. In French. Addendum, *ibid.*, 31st Aug. 1955, Vol. 28, No. 4, pp. 345–344.) A circuit for operation at frequencies up to 25 Mc/s, based on the secondary-emission-valve pulse generator described in 3532 above.

621.375.121 : 621.372.542.2 **3539**

Design of Low-Pass Amplifiers for Fast Transients.—G. Thirup. (*Philips Res. Rep.*, June 1955, Vol. 10, No. 3, pp. 216–230.) The proposed synthesis of an interstage coupling network for wide-band low-pass amplifiers is based on Darlington's design method (2742 of 1952). Some practical details are given of a 50-Mc/s amplifier; experimentally determined phase and amplitude characteristics are presented graphically; oscillograms of the transient response are shown. Details are also given of the design of a phase-correction network.

621.375.13.018.3 **3540**

The Mechanism of Subharmonic Generation in a Feedback System.—J. C. West & J. L. Douce. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 569–574. Discussion, pp. 594–595.) Analysis is given for nonlinear feedback systems, using the description-function method. Subharmonics are produced as a result of modification of the response of the nonlinear element by the input signal. Conditions are derived for the absence of subharmonic oscillations. Theoretical and experimental results for a particular unit with an approximately cubic characteristic are in agreement.

621.375.2 + 621.373.4 + 621.317.3].029.6 **3541**

Disc-Seal Circuit Techniques.—J. Swift. (*Proc. Instn Radio Engrs Aust.*, July–Sept. 1955, Vol. 16, Nos. 7–9, pp. 205–217, 247–260 & 295–307.) A survey of amplifiers and oscillators using disk-seal valves, and of associated microwave measurement methods.

621.375.221.2 **3542**

On Distributed Amplification.—D. G. Sarma. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 689–697.) The response characteristics of a distributed amplifier can be improved by making the delay characteristics of the anode and grid lines different, this technique being termed 'staggering'. The improvement is illustrated by photographic records of the responses of experimental amplifiers.

621.375.223 : 621.372.543.2 **3543**

Filters with Very Narrow Pass Band variable on the Principle of the Fabry-Pérot Interferometer.—G. Raoult & J. C. Pecker. (*C. R. Acad. Sci., Paris*, 4th July 1955, Vol. 241, No. 1, pp. 25–27.) Analysis is given for a narrow-band r.f. amplifier with n equal stages each comprising a valve and a three-mesh *CR* phase-shift network. Maximum gain is obtained at a frequency slightly different from that for which the phase shift is $2\pi n$. A relative bandwidth of 2×10^{-4} is attainable with 10 stages.

621.375.232 **3544**

Note on the Design of Wide-Band Low-Noise Amplifiers.—D. Weighton. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1096–1101.) Methods of reconciling the design requirements for minimum noise factor and those for adequate bandwidth are discussed. The problem can be solved by equalization using either feedback or complementary networks. Some measurements on an experimental grounded-cathode amplifier with feedback are reported; satisfactory performance with bandwidths up to about 20 Mc/s appears possible.

621.375.3 **3545**

Figure of Merit in Magnetic Amplifiers.—J. T. Carleton & W. F. Horton. (*Tele-Tech & Electronic Ind.*, June 1955, Vol. 14, No. 6, pp. 96–97..170.) The figure of merit discussed is the ratio of power amplification to amplifier response time. It is useful as a basis for the comparison of amplifiers which are linear over the working range and have equal rated output powers.

621.375.4 : 621.314.7 **3546**

Transistor Operating Points.—R. E. Skipper. (*Tele-Tech & Electronic Ind.*, June 1955, Vol. 14, No. 6, pp. 104–105..182.) A theoretical and experimental investigation is reported of the relation between the junction-transistor noise and gain and the collector-to-base voltage; the results are used in the design of a high-gain low-noise amplifier.

621.375.4 : 621.314.7 **3547**

Automatic Gain Control of Transistor Amplifiers.—W. F. Chow & A. P. Stern. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1119–1127.) Satisfactory a.g.c. circuits can be designed based on variation of either emitter current I_e or collector voltage V_c. The required control power is very low if the variation of I_e or V_c is produced by varying the base current. Distortion may become a serious problem.

621.375.4 : 621.314.7 **3548**

Transistor Equivalent Circuits.—Cocking. (See 3780.)

621.375.4.029.3 **3549**

Transistor-Equipped Light-Weight Programme-Input Amplifier Type V79.—H. H. Lammers. (*Tech. Hausmitt. NordwDtsch. Rdfunks*, 1955, Vol. 7, Nos. 5/6, pp. 94–100.) An amplifier for a portable sound recorder is described. In the pre-amplifier the microphone is matched to the first transistor via a transformer. By use of current feedback in the first stage it is possible to connect without attenuation capacitance microphones with terminal resistance > 1 kΩ. The second stage includes a feedback circuit providing equalization up to 15 kc/s. The final stage is designed for an output of 32 mW. Shifting of the working point due to internal heating is reduced by use of a special stabilizing circuit.

621.374.3 **3550**

Millimicrosecond Pulse Techniques. [Book Review]—I. A. D. Lewis & F. H. Wells. Publishers: McGraw-Hill, New York, and Pergamon Press, London, 1954, 310 pp., 40s. (*Science*, 10th June 1955, Vol. 121, No. 3154, p. 826.) A survey with an excellent bibliography.

GENERAL PHYSICS

53.05 **3551**

Note on Carpet Graphs.—J. R. Ellis. (*Engineer, Lond.*, 24th June 1955, Vol. 199, No. 5187, pp. 869–870.) Description of a method developed at the National Physical Laboratory for presenting information concerning three variables in a single combined graph.

535.376 **3552**

Theory of Electroluminescence.—W. W. Piper & F. E. Williams. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1809–1813.) On the basis of the threshold value of the field necessary to excite luminescence, the following three possible mechanisms are discussed: (*a*) direct ionization of impurity systems by the field; (*b*) acceleration of conduction electrons or valence-band holes to velocities sufficient to produce excitation by inelastic collisions; (*c*) injection of charge carriers.

535.6 **3553**

Empirical Relationships with the Munsell Value Scale.—J. H. Ladd & J. E. Pinney. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1137.) A discussion relevant to the establishment in colour television of an equal-step grey scale.

535.6.08 **3554**

The Specification of Colours based on Measurements with the Trichromatic Colorimeter.—F. Blottiau. (*Cah. Phys.*, Feb. 1955, No. 54, pp. 37–52.)

537.22 **3555**

A General Mathematical Treatment applicable to certain Electrode Systems.—G. Power. (*Brit. J. appl. Phys.*, July 1955, Vol. 6, No. 7, pp. 245–247.) Formulae are developed for a basic system of two coaxial dielectric cylinders of different homogeneous and isotropic media containing an embedded line charge. These are applied to determine the fields in a circular-cylinder electrode system, the results being expressed as series converging reasonably rapidly. Other electrode systems considered are a semi-infinite strip, an elliptic cylinder and a parabolic cylinder.

537.311.1 **3556**

On the Theory of Plasma Oscillations in Metals.—H. Kanazawa. (*Progr. theor. Phys., Osaka*, March 1955, Vol. 13, No. 3, pp. 227–242.) The effect of the crystal lattice on plasma oscillations is investigated on the basis of quantum mechanics. See also 1023 of 1954 (Wolff) and 1613 of June (Hubbard).

537.311.33 : 535.35 **3557**

Application of the Method of Generating Function to Radiative and Nonradiative Transitions of a Trapped Electron in a Crystal.—R. Kubo & Y. Toyozawa. (*Progr. theor. Phys., Osaka*, Feb. 1955, Vol. 13, No. 2, pp. 160–182.) See also 3449 of 1952 (Kubo).

537.52 **3558**

Measurement of the Statistical Time Lag of Breakdown in Gases and Liquids.—R. F. Saxe & T. J. Lewis. (*Brit. J. appl. Phys.*, June 1955, Vol. 6, No. 6, pp. 211–216.)

537.525 : 538.56.029.6 **3559**

The Direct Current associated with Microwave Gas Discharge between Coaxial Cylinders: Part 4.—K. Mitani. (*J. phys. Soc. Japan*, May 1955, Vol. 10, No. 5, pp. 391–397.) Measurements made by a double-probe method give results in good agreement with theory. Part 3: *ibid.*, Sept./Oct. 1953, Vol. 8, No. 5, pp. 642–645.

537.525 : 538.56.029.6 **3560**

Investigation of High-Frequency Discharge by Method of Probes.—Kh. A. Dzherpetov & G. M. Pateyuk. (*Zh. eksp. teor. Fiz.*, March 1955, Vol. 28, No. 3, pp. 343–351.) The methods used by Banerji & Ganguli (*Phil. Mag.*, Feb. 1931, Vol. 11, No. 69, pp. 410–422) and by Beck (*Z. Phys.*, 18th Oct. 1935, Nos. 5/6, pp. 355–375) were compared experimentally; the results obtained in the two cases were similar. A study was also made of the temperature, concentration of electrons and potential along the axis of the discharge tube at various pressures between about 0·1 and 1 mm Hg of H_2, Ar, and Ne at frequencies of the order of 100 Mc/s; the distribution was found to depend on the gas pressure, the diameter of the tube and the h.f. field strength. Results are presented graphically.

537.525.5 **3561**

Retrograde Motion in Gas Discharge Plasmas.—K. G. Hernqvist & E. O. Johnson. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1576–1583.) A phenomenon observed in cylindrical diodes operating in the ball-of-fire mode [959 of 1952 (Malter et al.)] is discussed.

537.525.8 **3562**

Diffusion in Moving Striations.—V. D. Farris. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 383–385.) A digest is presented of a thesis developing a diffusion theory of striations and testing the theory with experimental results reported by Pupp (*Phys. Z.*, 15th Jan. 1935, Vol. 36, No. 2, pp. 61–69).

537.525.8 **3563**

Field Measurements in Glow Discharges with a Refined Electron-Beam Probe and Automatic Recording.—R. Warren. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1650–1658.)

537.525.8 **3564**

Interpretation of Field Measurements in the Cathode Region of Glow Discharges.—R. Warren. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1658–1664.)

537.533/.534 **3565**

Self-Focusing Streams.—W. H. Bennett. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1584–1593.) A restatement of the theory of magnetic self-focusing of streams comprising a mixture of ions and electrons. See also 126 of January (Bennett & Hulburt).

537.533/.534 : 538.691 **3566**

The Theoretical Possibility of separating Beams of Charged Particles having Different Polarizations in a Magnetic Field.—V. V. Vladimirski. (*C. R. Acad. Sci. U.R.S.S.*, 21st June 1955, Vol. 102, No. 6, pp. 1099–1100. In Russian.) It is shown that a separation of beams such as is obtained in the Stern-Gerlach experiment can theoretically be obtained also in the case of charged particles.

537.533 : 539.211 **3567**

Electron Emission and Other Phenomena on Freshly Disturbed Metal Surfaces.—L. Grunberg. (*Research, Lond.*, June 1955, Vol. 8, No. 6, pp. 210–214.) A general account of the effects and methods of observing them using an open-ended Geiger counter or a photographic plate. See also 2301 of 1953 (Kramer).

537.533.7 **3568**

A Note on the Diffusion in a Gas of Electrons from a Small Source.—L. G. H. Huxley & R. W. Crompton. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 381–383.)

537.533.7 : 538.63 **3569**

Experimental Investigation of the Motions of Electrons in a Gas in the Presence of a Magnetic Field.—B. I. H. Hall. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 334–341.) The aim of this investigation was to verify the theory given by Huxley & Zaazou (*Proc. roy. Soc. A*, 7th April 1949, Vol. 196, No. 1046, pp. 402–426).

537.533.8 **3570**

Secondary Electron Emission.—S. Rodda. (*Nature, Lond.*, 25th June 1955, Vol. 175, No. 4469, pp. 1112–1114.) Report of colloquium held at the Institute of Physics in March 1955.

537.533.8 **3571**

Secondary Electron Emission by Primary Electrons in the Energy Range of 20 keV to 1·3 MeV.—B. L. Miller & W. C. Porter. (*J. Franklin Inst.*, July 1955, Vol. 260, No. 1, pp. 31–39.) Experiments were made using a primary beam from a small linear accelerator, after passage through a magnetic analyser, and targets of various metals. The secondaries comprised two groups, one with energy mainly < 30 eV and the other, possibly elastically scattered, with high energies. Curves show both the total secondary emission and the high-energy component as functions of primary voltage for various target metals; for a gold target the energy spectrum of the low-velocity secondaries is investigated. Another graph shows the high-energy components plotted against the atomic number of the target metal. Some experiments with insulator targets are briefly reported.

537.533.8 : 621.38.032.11 **3572**

A Demountable Vacuum System for Secondary-Emission Studies.—A. Lempicki. (*J. sci. Instrum.*, June **1955**, Vol. 32, No. 6, pp. 221–223.)

537.56 **3573**

The Growth of an Electron Avalanche retarded by its Own Space Charge.—G. Francis. (*Proc. phys. Soc.*, 1st June **1955**, Vol. 68, No. 426B, pp. 369–380.) The calculation presented shows how the ionization coefficient α and the total multiplication in the avalanche vary with the distance travelled when the positive ions formed have an appreciable effect. The time taken for an avalanche to develop is also calculated. The cases of (*a*) constant field at electrodes, and (*b*) constant potential between them are considered, assuming plane parallel geometry.

537.56 **3574**

Passage of Charged Particles through Plasma.—J. Neufeld & R. H. Ritchie. (*Phys. Rev.*, 15th June **1955**, Vol. 98, No. 6, pp. 1632–1642.) A phenomenological approach is used to examine the behaviour of a dispersive plasma and determine its response to an external disturbance, in particular that created by a moving point charge. The validity of this approach is discussed. An analysis is made of the field and the polarization charge density produced by an incident particle and the effectiveness of the plasma in stopping the particle.

537.56 **3575**

Microwave Study of Positive-Ion Collection by Probes.—G. J. Schulz & S. C. Brown. (*Phys. Rev.*, 15th June **1955**, Vol. 98, No. 6, pp. 1642–1649.) The electron density in a plasma is determined from the shift in resonance frequency of a cavity in which a discharge is maintained. The results are used to verify theory of positive-ion collection by negatively biased or double probes. Experiments were performed in H, Ar and He at pressures from 0·05 to 6 mm Hg. Agreement between experimental and theoretical results is good at the lower pressures; at high pressures the probe collected about twice the current predicted by theory.

538.3 **3576**

A Short Modern Review of Fundamental Electromagnetic Theory.—P. Hammond. (*Proc. Instn elect. Engrs*, Part B, Sept. **1955**, Vol. 102, No. 5, pp. 716–717.) Further discussion on 97 of January.

538.3 : 52 **3577**

Magneto-Hydrodynamics.—V. C. A. Ferraro. (*Nature, Lond.*, 6th Aug. **1955**, Vol. 176, No. 4475, pp. 234–237.) Report of a Royal Society discussion held in May 1955.

538.3 : 538.6 **3578**

Electromagnetic Field Equations for a Moving Medium with Hall Conductivity.—J. H. Piddington. (*Mon. Not. R. astr. Soc.*, **1954**, Vol. 114, No. 6, pp. 638–650.) The well known equation representing the electromagnetic field in a moving isotropic conductor is adapted to treat the case of an anisotropic conductor, such as an ionized gas moving in a strong magnetic field, by introducing a tensor conductivity. The modified equation is used to analyse astrophysical problems, including the propagation of magnetohydrodynamic waves.

538.56 : 538.6 **3579**

The Motion of Ionized Gas in Combined Magnetic, Electric and Mechanical Fields of Force.—J. H. Piddington. (*Mon. Not. R. astr. Soc.*, **1954**, Vol. 114, No. 6, pp. 651–663.) "Transient electric and mechanical forces uniform in space are applied to a gas in the presence of a steady magnetic field. The current transport equation for the anisotropically conducting medium is used to determine the subsequent motion of the gas, the internal electric field and the current density. These are damped oscillatory functions leading to a steady state. There is a close connection between the effects of the electric and mechanical forces; a steady internal electric field perpendicular to the magnetic field cannot exist unless accompanied by a mechanical force. The relationship between the two is examined."

538.56.029.6 **3580**

Cerenkov Radiation and its Applications.—J. V. Jelley. (*Brit. J. appl. Phys.*, July **1955**, Vol. 6, No. 7, pp. 227–232.)

538.566 **3581**

Reflection at Arbitrary Incidence from a Parallel Wire Grid.—J. R. Wait. (*Appl. sci. Res.*, **1955**, Vol. B4, No. 6, pp. 393–400.) The analysis presented is valid for any direction of polarization, angle of incidence or value of wire conductivity.

538.566 : 535.43] + 534.2 **3582**

On the Scattering of Spherical Waves by a Cylindrical Object.—J. R. Wait. (*Appl. sci. Res.*, 1955, Vol. B4, No. 6, pp. 464–468.) Analysis indicates that the ratio of the amplitude of the scattered field for a spherical incident wave to that for a plane wave is equal to $[\rho_0/(\rho_0 + \rho)]^{\frac{1}{2}}$, where ρ_0 is the distance of the source and ρ that of the observer from the cylinder axis.

538.569.4 : 621.372.029.64 **3583**

Revolutionary New Oscillator-Amplifier.—F. Shunaman. (*Radio-Electronics*, June **1955**, Vol. **26**, No. 6, pp. 56–57.) Short simplified description of the 'maser' (name derived from 'microwave amplification by stimulated emission of radiation'). See also 100 of January (Gordon et al.).

538.569.4.029.6 : 535.33.08 **3584**

A Microwave Spectrometer and its Applications to some Organic Molecules.—G. Erlandsson. (*Ark. Fys.*, 13th May **1955**, Vol. 9, Part 5, pp. 399–434.) A Stark-modulated microwave spectrometer operating in the frequency range 12–25 kMc/s is described in detail; circuit diagrams are given. Spectra of several asymmetric-top molecules have been investigated.

538.569.4.029.6 : 538.61 **3585**

Some Magneto-optical Phenomena connected with the Molecular Resonance of Gases at Microwave Frequencies.—A. Gozzini. (*J. Phys. Radium*, May **1955**, Vol. 16, No. 5, pp. 357–359.) The production of birefringence and Faraday rotation is discussed quantitatively with particular reference to NH_3.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

52 : 538.3 **3586**

Magneto-Hydrodynamics.—Ferraro. (See **3577**.)

523.16 **3587**

New Science of Radio Astronomy.—B. J. Bok. (*Sci. Mon.*, June **1955**, Vol. 80, No. 6, pp. 333–345.) A review of research methods and results, based on an address delivered to the American Association for the Advancement of Science.

523.16 **3588**

The Spatial Distribution and the Nature of Radio Stars.—M. Ryle & P. A. G. Scheuer. (*Proc. roy. Soc. A*, 12th July 1955, Vol. 230, No. 1183, pp. 448–462.) Data obtained from a survey of radio stars by Shakeshaft et al. (to be published in *Mem. R. astr. Soc.*) are analysed. The results indicate an apparent increase in the spatial distribution density with distance in all directions. A reasonable interpretation of the results cannot be provided unless most of the stars are assumed to be outside the galaxy.

523.16 **3589**

An Alternative Identification of the Radio Source in the Direction of the Galactic Centre.—R. D. Davies & D. R. W. Williams. (*Nature, Lond.*, 18th June 1955, Vol. 175, No. 4468, pp. 1079–1081.) An attempt has been made to determine the distance of the radio source observed e.g. by McGee & Bolton (2932 of 1954) from the absorption by interstellar hydrogen at 1·42 kMc/s. The results suggest that this source is considerably closer than the galactic nucleus.

523.16 **3590**

Radio Emission from Jupiter.—(*Nature, Lond.*, 18th June 1955, Vol. 175, No. 4468, p. 1074.) Brief report of reception at Seneca, Maryland, of radiation on 22 Mc/s; a large cross aerial was used of the type developed by Mills [see e.g. 633 of 1954 (Mills & Little)]. The effect in a broadcast receiver was similar to that with thunderstorm interference. See also 2933 of October (Burke & Franklin).

523.16 **3591**

Radio Waves from the Planet Jupiter and a Cosmogonic Hypothesis.—Q. Majorana. (*R. C. Accad. naz. Lincei*, June 1955, Vol. 18, No. 6, pp. 577–580.) The reported observation of radiation at about 22 Mc/s [2933 of October (Burke & Franklin)] is discussed in relation to theories concerning physical conditions on Jupiter. It is suggested that Saturn may also emit radio waves, but with lower intensity. Theoretical considerations indicate that astral heat and light may be a direct effect of the gravitational force.

523.5 : 537.56 **3592**

Meteor Radiation, Ionization and Atomic Luminous Efficiency.—E. J. Öpik. (*Proc. roy. Soc. A*, 12th July 1955, Vol. 230, No. 1183, pp. 463–501.) A theoretical paper; empirically constructed tables are presented for calculating the radiation from meteors.

523.72 : 550.385 **3593**

Corpuscular Streams.—R. C. Jennison. (*Observatory*, June 1955, Vol. 75, No. 886, pp. 125–126.) Solar emission of particles giving rise to variations of the geomagnetic field [2494 of 1952 (Kiepenheuer)] is discussed. If the stream of particles is borne in the wake of a shock wave with a velocity of the order of 1 500 km/s, complete transport of material from the sun to the earth need not be postulated. The steep nature of the shock front is consistent with the sudden commencement of magnetic storms.

523.746 **3594**

Provisional Determination of the Mean Length of the 80-Year Sunspot Cycle.—W. Gleissberg. (*Naturwissenschaften*, July 1955, Vol. 42, No. 14, p. 410.) Analysis of available data shows that during the past 16 centuries the duration of the 80-year cycle has fluctuated between five and eleven 11-year cycles, the mean being (7·1 ± 0·3) 11-year cycles; taking the mean duration of the 11-year cycle as 11·1 years, this corresponds to a range 75·5 — 82·1 and a mean value 78·8 years.

523.75 : 550.385 : 537.591 **3595**

Solar Flare and Magnetic Storm Effects in Cosmic-Ray Intensity near the Geomagnetic N Pole.—J. W. Graham & S. E. Forbush. (*Phys. Rev.*, 1st June 1955, Vol. 98, No. 5, pp. 1348–1349.) Phenomena observed during and following the solar flare of 25th July 1946 are discussed. If the observed increase in cosmic-ray intensity was due to charged particles from the sun, the trajectories must have been strongly affected by factors other than the geomagnetic field.

550.372 **3596**

Measurement of Soil Conductivity by the Wave-Tilt Method.—S. C. Mazumdar. (*J. Instn Telecommun. Engrs, India*, June 1955, Vol. 1, No. 2, pp. 76–83.) Description of the experimental arrangement and report of results obtained in the vicinity of Delhi.

550.38 **3597**

Geomagnetism.—(*Indian J. Met. Geophys.*, Dec. 1954, Vol. 5, Special Number, pp. 1–242.) This special number commemorates the golden jubilee of the Alibag observatory. The 30 papers presented include the following:—

The Contrast between Geomagnetic S and L at Huancayo (pp. 69–74).—J. Bartels.
Characteristics of Polar Magnetic Storms (pp. 75–88).—T. Nagata & N. Fukushima.
Ionospheric Magnetic Fields during Marked Decreases in Cosmic Rays (pp. 113–116).—S. E. Forbush & E. H. Vestine.
Magnetohydrodynamic Waves and Solar Prominences (pp. 133–136).—H. Alfvén.
Auroral Activity at Medium Latitudes (pp. 137–140).—A. Vassy & E. Vassy. In French.
Solar Radiation in the Far Ultraviolet and some Related Geophysical Phenomena (pp. 141–152).—A. K. Das.
On the Emission of Electric Currents from the Sun (pp. 157–160).—V. C. A. Ferraro.
Sunspots and Geomagnetic Variation (pp. 161–178).—S. K. Pramanik & M. K. Ganguli.
Magnetic Storms and Solar M Regions (pp. 179–188).—P. K. Sen Gupta.
The Dynamo Action of the Diurnal Atmospheric Oscillation (pp. 189–194).—R. Pratap.
Recurrence Tendency of Geomagnetic Activity during the Current Sunspot Minimum (pp. 195–202).—A. M. Naqvi & B. N. Bhargava.
Some Remarks on the Equatorial Electrojet, as revealed by the Analysis of Solar Flare Effects (pp. 203–212).—J. Veldkamp & J. G. Scholte.
Geomagnetic Records at Colaba and Alibag on Days of Solar Eclipse (pp. 213–220).—S. L. Malurkar.

Some others are abstracted individually.

550.380.8 **3598**

Apparatus for Measurement of the Intensity of the Terrestrial Magnetic Field.—R. Birebent. (*C. R. Acad. Sci., Paris*, 25th July 1955, Vol. 241, No. 4, pp. 368–369.) An adaptation of the device described previously (2367 of August).

550.385 **3599**

Notes on the Theory of Magnetic Storms.—S. Chapman. (*Indian J. Met. Geophys.*, Dec. 1954, Vol. 5, Special Number, pp. 33–40.) "A non-mathematical account is given of the model problems and their solutions, by which Chapman and Ferraro have sought to illustrate some aspects of the theory of magnetic storms. These problems are here used to develop a qualitative solution of the motion of an infinite neutral ionized plane sheet of gas (or of a succession of such sheets) towards a unidirectional magnetic field whose intensity decreases as an inverse power of the distance from an axis to which the sheet is parallel. The gas in the centre approaches to a minimum distance from the axis and then recedes again. The gas far to either side moves onward with little distortion. Between these central and outer parts there are two strips of the sheet whose ions and electrons separate from each other, under the influence of the magnetic field; partly because these strips become much extended and reduced to low density. Some charges are deviated away to infinity, others are captured by the field and build up a 'westward' electric current to which is ascribed the main phase of a magnetic storm."

550.385 : 551.510.535 **3600**

The Relation between the Geomagnetic Field and Range Disturbance in Various Latitudes.—R. P. W. Lewis & D. H. McIntosh. (*Indian J. Met. Geophys.*, Dec. 1954, Vol. 5, Special Number, pp. 51–62.) Analysis of observations leads to a theory of the mechanism of magnetic disturbances intermediate between the classical theory and that advanced by Nikolsky (3897 of 1947). The true storm-time effect is greatest at the equator; an additional effect comprising instantaneous response to and recovery from the disturbance is greatest in the auroral zone. The effect on the ionosphere at high latitudes is briefly considered.

551.51 : 061.3 **3601**

Assembly of the International Union for Geodesy and Geophysics, Rome 1954.—(*Ann. Géophys.*, April/June 1955, Vol. 11, No. 2, pp. 115–248.) The text is given of 11 papers, most of them in English, dealing with the structure of the atmosphere and especially with research by means of rockets since 1946.

551.510.53 **3602**

Dissociation of Oxygen in the Upper Atmosphere.—E. T. Byram, T. A. Chubb & H. Friedman. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1594–1597.) The O_2 content of the atmosphere at heights between 110 and 130 km was determined by measuring the transmission of solar radiation in the wavelength band from 1 425 to 1 500 Å, using an ultraviolet photon counter in a rocket. At 130 km the O_2 concentration was $10^{10}/cm^3$, indicating that 12% of the atmospheric oxygen was still undissociated.

551.510.535 **3603**

Determination of the True Distribution of Electron Density in the Ionosphere: Part 1.—W. Becker. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 277–284.) A survey leads to the conclusion that existing methods of investigating the electron-density distribution are either too inaccurate or too complicated for routine use. 51 references.

551.510.535 **3604**

Resonance Absorption of Sunlight in Twilight Layers.—T. M. Donahue & R. Resnick. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1622–1625.) Calculations are made relevant to the determination of the thickness of the atmospheric sodium layer, which appears to be located at a height between 70 and 115 km.

551.510.535 **3605**

New Representation of the Longitude Effect in the Ionosphere F_2 Layer.—F. Delobeau. (*C. R. Acad. Sci., Paris*, 25th July 1955, Vol. 241, No. 4, pp. 439–441.) The representation is based on a chart with geographic latitude as abscissa and magnetic latitude as ordinate. On plotting the positions of existing ionospheric stations the need for stations in certain regions is demonstrated, particularly for stations with south geographic and north magnetic latitude.

551.510.535 **3606**

Simultaneous Fluctuations of the F_2-Layer Ionization at Two Widely Spaced Observation Stations.—O. Burkard. (*Öst. Z. Telegr. Teleph. Funk Fernsehtech.*, May/June 1955, Vol. 9, Nos. 5/6, pp. 57–59.) Observations of short-term variations of f_0F_2 at Graz in Austria and at Capetown in S. Africa during January 1953 are compared. Correlation factors up to 0·725 were obtained for values observed at the same universal time, but the correlation decreases rapidly as the time difference between the measurements increases. The results support the view that the ionizing radiation itself undergoes short-term fluctuations.

551.510.535 **3607**

The Ionospheric F_2 Layer over India in Minimum Sunspot Year 1953.—K. R. Ramanathan & K. M. Kotadia. (*Indian J. Met. Geophys.*, Dec. 1954, Vol. 5, Special Number, pp. 117–122.) A summary of observations made at various stations in India.

551.510.535 **3608**

A Singular Echo Trace observed in Ionograms from the Kerguelen Islands Station.—R. Busch & A. Luchet. (*C. R. Acad. Sci., Paris*, 1st Aug. 1955, Vol. 241, No. 5, pp. 507–509.) Traces have been obtained indicating reflections from a layer at a height of 48–55 km in summer and 55–65 km in winter, corresponding to the temperature-maximum region at the upper boundary of the ozone layer. The results are in agreement with those of Major (3252 of November).

551.510.535 : 621.396.812.3.029.55 **3609**

Investigation of Vertical Movements of the F_2 Layer.—N. V. G. Sarma. (*Curr. Sci.*, June 1955, Vol. 24, No. 6, pp. 190–191.) Calculations based on observations of the rate of fading of 4·92-Mc/s signals and simultaneous independent determinations of E-layer vertical movements confirm that the vertical drift velocity of the F_2 layer at morning and evening is greater than that of the E layer.

551.594.5 **3610**

Diurnal Variation in Auroral Activity.—N. C. Gerson. (*Proc. phys. Soc.*, 1st July 1955, Vol. 68, No. 427B, pp. 408–414.) An analysis of amateur-radio contacts during the period 1949–1951, using v.h.f. transmissions incident obliquely to the ionized aurora, is compared with results obtained by radio soundings at normal incidence. Auroral activity shows a strong maximum at 2100 hours local time, with 86% of the total occurrences between 1700 and 2400 hours.

523.16 **3611**

Radio Astronomy. [Book Review]—J. L. Pawsey & R. N. Bracewell. Publishers: Geoffrey Cumberlege, Clarendon Press, Oxford, 1955, 354 pp., 55s. (*J. Brit. Instn Radio Engrs*, Aug. 1955, Vol. 15, No. 8, p. xi.) Intended primarily for physicists and astronomers.

523.5 : 621.396.96 **3612**

Meteor Astronomy. [Book Review]—A. C. B. Lovell. Publishers: Clarendon Press, Oxford; Oxford University Press, London, 1954, 463 pp., 60s. (*Nature, Lond.*, 23rd July 1955, Vol. 176, No. 4473, pp. 135–136.) A comprehensive up-to-date survey indicating the importance of radio techniques.

523.7 **3613**

The Sun (The Solar System—Vol. 1). [Book Review]—G. P. Kuiper (Ed.). Publishers: University of Chicago Press, Chicago; Cambridge University Press, London, 1953, 745 pp., 94s. (*Nature, Lond.*, 2nd July 1955, Vol. 176, No. 4470, p. 5.) Chapters on the various aspects of the subject are contributed by acknowledged leaders in the field, to produce a reference book for the specialist and a useful survey for the nonspecialist.

551.510.535 : 621.396.11 **3614**

The Physics of the Ionosphere. [Book Notice]—Publishers: The Physical Society, London, 1955, 406 pp., 40s. (*J. Brit. Instn Radio Engrs*, Aug. 1955, Vol. 15, No. 8, p. xi.) A collection of 50 papers presented at the Physical Society Conference held at Cambridge, England, in September 1954.

LOCATION AND AIDS TO NAVIGATION

621.396.96 : 535.37 : 551.46 **3615**

Radar and Phosphorescence at Sea.—B. Hilder. (*Nature, Lond.*, 23rd July 1955, Vol. 176, No. 4473, pp. 174–175.) Mariners' observations of phosphorescence apparently stimulated by radar are reported and discussed.

621.396.96 : 621.374.3 **3616**

Target Discriminator for Countermeasures.—M. Weiss & S. R. Sixbey. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 118–120.) A voltage-difference discriminator driven by the output from a logarithmic amplifier provides a device capable of discriminating between input voltage pulses of amplitudes in the ratio of 5 to 4, and independent of pulse width, repetition rate and absolute pulse amplitude.

621.396.96.029.65 : 551.578 **3617**

Measurements of the Effects of Rain, Snow and Fogs on 8·6-mm Radar Echoes.—N. P. Robinson. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 709–714.) Measurements of the attenuation caused by rain and of the back-scattered radiation agreed well with predictions from theory. The echo intensity from fogs was too low to be detected, but measurements of the attenuation of echoes from a corner reflector in fogs of different thicknesses were of the same order as the predicted values. The attenuation caused by moist snow was 2½ times that caused by rain with a similar precipitation rate. The echo intensity from the 'radar bright band' composed of melting snow was 14–19 db greater than that from the dry snow above and 2–8 db greater than that from the rain below.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.56 **3618**

The Final Vacua of Oil Diffusion Pumps.—R. F. Coe & L. Riddiford. (*J. sci. Instrum.*, June 1955, Vol. 32, No. 6, pp. 207–213.) Measurements of the vapour pressures of apiezon C, octoil S, DC 703 and some other oils by various methods are compared with final pressures measured with both ionization and Knudsen gauges. The residual molecules are decomposition products of the oil and vary with the type of oil; their average molecular weight is less than that of the oil.

535.215 : 546.482.21 : 539.231 **3619**

Production of Light-Sensitive Cadmium-Sulphide Films by Cathode Sputtering.—G. Helwig & H. König. (*Z. angew. Phys.*, July 1955, Vol. 7, No. 7, pp. 323–325.) The deposition of photoconductive CdS films on glass by sputtering Cd in an atmosphere of H_2S and an inert gas is described. The ratio of current at an illumination of 1 000 lux to the dark current is of the order of 10^4 to 10^5.

535.37 : 546.472.21 **3620**

Laws of Decay of Afterglow in Zinc-Sulphide Phosphors in Region of Temperature Quenching.—F. I. Vergunas & N. L. Gasting. (*Zh. eksp. teor. Fiz.*, March 1955, Vol. 28, No. 3, pp. 352–360.) An experimental investigation is reported on ZnS-Cu, ZnS-(Cu, Co) and ZnS-Zn phosphors. In all cases the decay of afterglow varied with temperature up to quenching temperature and with the intensity of the exciting light. As the temperature increased, the hyperbolic curve representing the early stages of the characteristic changed into an exponential curve; simultaneously, the hyperbolic curve representing the later stages of the decay shrank, so that at high temperatures the whole of the decay curve was approximately exponential. Corresponding results were obtained for the effect of intensity and duration of excitation. Results are presented graphically.

535.376 **3621**

Alternative Explanation of the Waymouth-Bitter Experiments.—L. Burns. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, p. 1863.) An alternative explanation is advanced of electroluminescence observations reported by Waymouth & Bitter (441 of February).

535.376 : 546.472.21 **3622**

Light Patterns in Electroluminescent ZnS Single Crystals activated by Diffusion of Cu.—G. Diemer. (*Philips Res. Rep.*, June 1955, Vol. 10, No. 3, pp. 194–204.)

535.376 : 546.472.21 **3623**

Some Aspects of the Voltage and Frequency Dependence of Electroluminescent Zinc Sulphide.—P. Zalm, G. Diemer & H. A. Klasens. (*Philips Res. Rep.*, June 1955, Vol. 10, No. 3, pp. 205–215.) "Experiment shows that the relation between the luminous emittance H of an electroluminescent cell and the applied r.m.s. voltage V is given by $H = H_0 \exp(-c/V^{\frac{1}{2}})$. A mechanism is proposed that may explain both the well-known linear frequency dependence at a constant r.m.s. voltage of the emittance and the observed voltage dependence."

537.221 : 546.48 **3624**

Work Function of Cadmium.—P. A. Anderson. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1739–1740.) Continuation of work reported previously (993 of 1953)

537.226 : 538.221 **3625**

Model for Magnetization Process in Ferrodielectrics.—M. N. Grigor'ev & I. M. Kirko. (*C. R. Acad. Sci. U.R.S.S.*, 1st June 1955, Vol. 102, No. 4, pp. 733–736. In Russian.) The magnetic properties of materials composed of steel spheres embedded in a quartz-sand insulating medium were investigated experimentally; results were compared with theory. Conclusions indicate that the effective permeability in a constant field and the dispersion in an alternating field can be determined if the following are known: (*a*) the permeability and dispersion of the steel, (*b*) its conductivity, and (*c*) the permeability of the ferrodielectric at one frequency in the dispersion region.

537.226 : 621.315.6 **3626**

Physics, Chemistry and Insulation.—C. G. Garton. (*J. Instn elect. Engrs*, Sept. 1955, Vol. 1, No. 9, pp. 576–580.) A short review with particular reference to von Hippel's two books, Dielectrics and Waves (2045 of July) and Dielectric Materials and Applications (3030 of October).

537.226.2 : 537.224 **3627**

Abnormal Increase in the Dielectric Constant of an Electret-Forming Material.—S. D. Chatterjee & T. C. Bhadra. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1728–1729.) "An electret with its two surfaces covered by plates which are connected together presents a situation in which the average (zero) field between the plates is composed of two equal and opposite parts, one due to the polarization and the other due to the charges on or adjacent to the plates. These opposing fields can be very large (~ 10^6 volts/cm) and as a result, large fluctuations may be expected in the vicinities of individual molecules. For these reasons it is surmised that the dielectric constant of the material of an electret may show an abnormal value, depending upon 'strength' of the electret. The experiments described verify the existence of such an abnormality."

537.227 **3628**

A Neutron-Diffraction Study of the Ferroelectric Transition of Potassium Dihydrogen Phosphate.—G. E. Bacon & R. S. Pease. (*Proc. roy. Soc. A*, 21st June 1955, Vol. 230, No. 1182, pp. 359–381.)

537.227 : 546.431.824-31 : 621.396.822 **3629**

Noise Generation in Crystals and in Ceramic Forms of Barium Titanate when Subjected to Electric Stress.—A. C. Kibblewhite. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 683–684.) Discussion on 1374 of May.

537.311.3 : 546.73.281 **3630**

The Crystal Structure of Co_2Si.—S. Geller & V. M. Wolontis. (*Acta Cryst.*, Feb. 1955, Vol. 8, Part 2, pp. 83–87.)

537.311.3 : 546.97.289 **3631**

The Rhodium-Germanium System: Part 1—The Crystal Structures of Rh_2Ge, Rh_5Ge_3 and RhGe.—S. Geller. (*Acta Cryst.*, 10th Jan. 1955, Vol. 8, Part 1, pp. 15–21.)

537.311.31 : 546.87 : 538.63 **3632**

Effect of Hydrostatic Pressure on the Galvanomagnetic Effects in Bi and its Alloys: Part 1.—N. E. Alekseevski & N. B. Brandt. (*Zh. eksp. teor. Fiz.*, March 1955, Vol. 28, No. 3, pp. 379–383.) Brief report of an experimental investigation at a pressure of 1 500 atm and at temperatures in most cases equal to or not much above that of liquid He. Results are presented graphically.

537.311.33 **3633**

Semiconductors: No Man's Land between Metals and Insulators.—R. W. Douglas. (*Nature, Lond.*, 18th June 1955, Vol. 175, No. 4468, pp. 1059–1061.) A simple introduction to the subject.

537.311.33 **3634**

Intermetallic Semiconductors. — I. M. Ross. (*Nature, Lond.*, 20th Aug. 1955, Vol. 176, No. 4477, pp. 341–343.) Report of a symposium held in April 1955 at the Services Electronics Research Laboratory, Baldock, Herts. Emphasis was on compounds of the zinc-blende type, particularly InSb.

537.311.33 **3635**

Ionic and Homopolar Bonds in Semiconductors.—I. M. Tsidil'kovski. (*C. R. Acad. Sci. U.R.S.S.*, 1st June 1955, Vol. 102, No. 4, pp. 737–740. In Russian.) A discussion relating to semiconductors such as oxides, sulphides and selenides.

537.311.33 : 538.63 **3636**

Galvanomagnetic Effects in Semiconductors.—O. Madelung. (*Naturwissenschaften*, July 1955, Vol. 42, No. 14, pp. 406–410.) A survey with particular reference to Hall effect and resistance variation due to the magnetic field.

537.311.33 : 538.63 **3637**

Theory of the Hall and Nernst-Ettingshausen Effects in Semiconductors with Mixed Conductivity.—F. G. Bass & I. M. Tsidil'kovski. (*Zh. eksp. teor. Fiz.*, March 1955, Vol. 28, No. 3, pp. 312–320.) The theoretical discussion presented is based on the assumption of a law for the mean free path l of the form $l = \Phi(T) v^n$, where $\Phi(T)$ is a function of temperature, v is the velocity of the charge carriers and n has the same value for electrons and holes.

537.311.33 : 539.15 **3638**

Overhauser Effect in Nonmetals.—A. Abragam. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1729–1735.) A survey is made of different ways in which nuclear spins can relax through their interaction with electronic spins. The case of a paramagnetic ion is examined in detail with reference to Honig's experiment on As-doped Si (753 of March).

537.311.33 : 54 **3639**

Chemical Aspects of Semiconductors.—F. S. Stone. (*Nature, Lond.*, 23rd July 1955, Vol. 176, No. 4473, pp. 153–155.) Brief report of symposium held at Reading in March 1955.

537.311.33 : 546.26-1 **3640**

Semiconductivity of a Type II*b* Diamond.—J. F. H. Custers. (*Nature, Lond.*, 23rd July 1955, Vol. 176, No. 4473, pp. 173–174.) The semiconductor properties of this class of diamond are thought to be due to crystal imperfections. The temperature variation of conductivity obeys an exponential law. In a particular specimen the energy gap was 0·70 eV. Rectification is obtainable. All blue diamonds are of this type, though not all of this type are blue.

537.311.33 : [546.28 + 546.289 **3641**

Optical and Impact Recombination in Impurity Photoconductivity in Germanium and Silicon.—N. Sclar & E. Burstein. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1757–1760.) Factors affecting the time taken to restore charge-carrier equilibrium are investigated by comparing the nonradiative, radiative and three-body recombination coefficients calculated on the basis of a simple model with hydrogen-like impurity centres. None of the mechanisms considered is consistent with time constants as short as those observed.

537.311.33 : [546.28 + 546.289 **3642**

Electron Voltaic Study of Electron Bombardment Damage and its Thresholds in Ge and Si.—J. J. Loferski & P. Rappaport. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1861–1863.)

537.311.33 : 546.28 **3643**

Solution of the Hartree-Fock-Slater Equations for Silicon Crystal by the Method of Orthogonalized Plane Waves.—T. O. Woodruff. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1741–1742.)

537.311.33 : 546.28 **3644**

Pressure Dependence of the Resistivity of Silicon.—W. Paul & G. L. Pearson. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1755–1757.) Measurements made on high-purity single crystals of Si in the intrinsic range indicate that the energy gap narrows as the applied pressure increases.

537.311.33 : 546.28 **3645**

Interpretation of Donor-State Absorption Lines in Silicon.—W. Kohn. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1856–1857.)

537.311.33 : 546.28 **3646**

Infrared Absorption of Silicon near the Lattice Edge.—G. G. Macfarlane & V. Roberts. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1865–1866.) Report of measurements over the temperature range 20°–3 330°K.

537.311.33 : 546.289 **3647**

Fast-Neutron Bombardment of *n*-Type Ge.—J. W. Cleland, J. H. Crawford, Jr, & J. C. Pigg. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1742–1750.) Report of an extensive experimental study. The results indicate that the neutron bombardment produces two vacant states in the energy gap, one deep and one shallow. Mobility studies indicate that scattering associated with bombardment-induced lattice disorder is more complex than that due to charged impurities. Appreciable photoconductivity associated with minority-carrier trapping is produced.

537.311.33 : 546.289 **3648**

Microwave Determination of the Average Masses of Electrons and Holes in Germanium.—J. M. Goldey & S. C. Brown. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1761–1763.) A determination of the dielectric constant was made by measuring the complex transmission coefficient at 24·15 kMc/s through a thin slab of Ge at several temperatures. Values of the effective masses of electrons and holes thus determined are $(0{\cdot}09 \pm 0{\cdot}05)m_0$ and $(0{\cdot}30 \pm 0{\cdot}05)m_0$ respectively.

537.311.33 : 546.289 **3649**

Water-Vapor-Induced *n*-Type Surface Conductivity on *p*-Type Germanium.—R. H. Kingston. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1766–1775.) Measurements have been made of the *n*-type surface conductance of the *p*-type region in an *n-p-n* transistor, using a direct-reading instrument in contrast to the bridge measurements made by Brown (166 of 1954). From the results it is deduced that the density and type of carrier at the surface of an etched Ge crystal depend on the surface treatment and surrounding gas rather than on the carrier concentration in the bulk material. See also 1951 of 1954.

537.311.33 : 546.289 **3650**

Electrical Breakdown in Germanium at Low Temperatures.—F. J. Darnell & S. A. Friedberg. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1860–1861.) Report of an investigation of current/electric-field characteristics at different values of temperature and transverse magnetic field. Values of carrier mean free time and path are deduced.

537.311.33 : 546.289 **3651**

New Radiation resulting from Recombination of Holes and Electrons in Germanium.—J. R. Haynes. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1866–1868.) In addition to a previously reported radiation maximum at about 1·8 μ wavelength, evidence has been found for a second radiation maximum at about 1·5 μ.

537.311.33 : 546.289 **3652**

Surface Recombination in Germanium in the Presence of Strong Electric Fields.—H. K. Henisch & W. N. Reynolds. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 353–356.) The effect on the surface recombination velocity of a field normal to the crystal surface was investigated experimentally using Many's method (2129 of 1954) to determine the minority-carrier lifetime. The *n*- and *p*-type specimens were about 0·05 cm thick, 0·4 cm wide and 1·5–3 cm long; the resistivities varied between 5 and 12 Ω.cm. The surface-recombination-velocity/applied-voltage curves obtained had similar slopes for both types of specimen. A possible theoretical explanation of the results is discussed.

537.311.33 : 546.289 **3653**

A Pulse Method for measuring the Injection Ratio of Metal-Semiconductor Contacts.—G. G. E. Low. (*Proc. phys. Soc.*, 1st July 1955, Vol. 68, No. 427B, pp. 447–452.) A tungsten point contact connected to a constant-current pulse generator divides a filamentary specimen of *n*- or *p*-type Ge so as to form two arms of a bridge circuit. The change in conductance of the specimen with time after injection of a current pulse is measured. Curves of injection ratio against emitter current are given for various conditions.

537.311.33 : 546.289 **3654**

On the Behavior of Rapidly Diffusing Acceptors in Germanium.—F. van der Maesen & J. A. Brenkman. (*J. electrochem. Soc.*, May 1955, Vol. 102, No. 5, pp. 229–234.) Experiments on the acceptor activity and diffusion of Cu and Ni in Ge are reported. The results are interpreted as indicating that these impurities may occur both substitutionally and interstitially in the lattice, different diffusion constants being appropriate for the two cases.

537.311.33 : 546.289 **3655**

Magnetic Susceptibility of Germanium.—G. Busch & N. Helfer. (*Helv. phys. Acta*, 30th June 1954, Vol. 27, No. 3, pp. 201–204. In German.) Measurements on single crystals were made over the temperature range 56°–1180°K. The susceptibility passes through a maximum value at about 800°K. The effect of thermally produced holes is discussed.

537.311.33 : 546.289 **3656**

Charge-Carrier Susceptibility and Cyclotron Resonance of Germanium.—C. Enz. (*Helv. phys. Acta*, 31st May 1955, Vol. 28, Nos. 2/3, pp. 158–166. In German.) On the basis of energy-band theory, the carrier susceptibility in the intrinsic range is calculated and compared with experimental results obtained by Busch & Helfer (3655 above). The agreement between theoretical and experimental results is much better if the number of families of ellipsoids in the conduction band is taken to be 4 rather than 8.

537.311.33 : 546.289 **3657**

Germanium in Some of the Waste-Products from Coal.—K. V. Aubrey. (*Nature, Lond.*, 16th July 1955, Vol. 176, No. 4472, pp. 128–129.) Experimental investigations are reported leading to conclusions differing in some respects from those of Forrest et al. (2659 of September). Possible reasons are discussed for the lower concentrations of Ge encountered in power-station boiler deposits as compared with deposits from the waste-gas flues of producer-gas plant.

537.311.33 : 546.289 : 539.32 **3658**

Elastic Constants of Germanium between 1·7° and 80°K.—M. E. Fine. (*J. appl. Phys.*, July 1955, Vol. 26, No. 7, pp. 862–863.)

537.311.33 : 621.314.632.1 **3659**

The Effect of Field-Dependent Mobilities on the Diffusion Theory of Rectification.—P. T. Landsberg. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 366–368.) A note on the theoretical part of Lees' work (462 of 1954) showing that if the mobility and diffusion coefficient of the current carriers are subjected to a much smaller fractional change, as a function of position in the barrier layer, than is the electric field, then many results of the general theory of barrier-layer rectifiers remain essentially unchanged.

537.311.33 : 621.314.7 **3660**

Semiconductors and Transistors: some Current Problems.—J. R. Tillman. (*Nature, Lond.*, 2nd July 1955, Vol. 176, No. 4470, pp. 9–11.) A concise survey of the existing state of knowledge.

537.311.33 : 621.396.822 **3661**

Electronic Fluctuations in Semiconductors.—R. E. Burgess. (*Brit. J. appl. Phys.*, June 1955, Vol. 6, No. 6, pp. 185–190.) Various types of electrical fluctuations which occur in a semiconductor are compared with the corresponding processes in a vacuum tube. The types considered include thermal, shot, partition, avalanche and modulation noise, the last-mentioned being conspicuous at low frequencies, especially when current-carrying contacts or barriers occur.

537.311.33 : 669.046.54 **3662**

Zone Melting Apparatus.—(*Tech. News Bull. nat. Bur. Stand.*, June 1955, Vol. 39, No. 6, p. 81.) Automatic apparatus for producing high-purity semiconductors uses a water-cooled r.f. heating coil concentric with a vycor tube which surrounds the boat holding a bar of the semiconductor. The coil is motor-driven along the tube.

537.311.33 : 669.046.54 : 546.289 **3663**

Zone Melting.—W. G. Pfann & K. M. Olsen. (*Bell Lab. Rec.*, June 1955, Vol. 33, No. 6, pp. 201–205.) A short illustrated description of the method of purifying Ge crystals, or producing a desired constituent distribution, by repeated crystallization, the Ge ingot in a graphite boat being traversed through a series of induction heating coils.

538.22 **3664**

Tentative Interpretation of the Magnetic Properties at High Temperature of the Rhombohedral Sesquioxides of Titanium, Vanadium, Chromium, and Iron (Ti_2O_3, V_2O_3, Cr_2O_3 and Fe_2O_3).—J. Wucher. (*C. R. Acad. Sci., Paris*, 18th July 1955, Vol. 241, No. 3, pp. 288–290.)

538.22 : 621.318.134 **3665**

A Review of the Structure and some Magnetic Properties of Ferrites.—L. C. F. Blackman. (*J. Electronics*, July 1955, Vol. 1, No. 1, pp. 64–77.)

538.221 **3666**

Density of States of Conduction Electrons in Ferromagnetics.—A. V. Sokolov & S. M. Tsipis. (*Zh. eksp. teor. Fiz.*, March 1955, Vol. 28, No. 3, pp. 321–325.) The calculation presented is based on a model with *s-d* electron interaction.

538.221 **3667**

Some Magnetic Properties of Dilute Ferromagnetic Alloys: Part I.—G. Bate, D. Schofield & W. Sucksmith. (*Phil. Mag.*, June 1955, Vol. 46, No. 377, pp. 621–631.) An account is given of an investigation into the variation with heat treatment of the magnetic properties of Cu-Co and Cu-Fe alloys containing small percentages of ferromagnetic component. A maximum in the coercivity is found which is thought to be associated with single-domain precipitates; the characteristics of the hysteresis loops at this stage indicate coercivities $>$ 1 000 oersted.

538.221 **3668**

The Influence of Temperature on Magnetic Viscosity.—J. H. Phillips, J. C. Woolley & R. Street. (*Proc. phys. Soc.*, 1st June 1955, Vol. 68, No. 426B, pp. 345–352.) Extension of earlier work (3272 of 1954). Measurements were made to demonstrate the influence of temperature on irreversible magnetic viscosity in different types of precipitation alloys: Pt-Co, Ni_3Au, and alnico in an undeveloped state.

538.221 **3669**

The Absence of Bloch Walls in Certain Ferromagnetic Materials.—P. M. Prache. (*Câbles & Transm.*, July 1955, Vol. 9, No. 3, p. 228.) Corrections to paper abstracted in 3018 of October.

538.221 **3670**

Low-Temperature Evolution of the Coercive Force of Finely Divided Nickel.—L. Weil. (*C. R. Acad. Sci., Paris*, 1st Aug. 1955, Vol. 241, No. 5, pp. 470–472.) Measurements of the coercive force were made at progressively lower temperatures on Ni powders prepared by reduction. The results are not affected by applied magnetic fields, but are strongly affected by the thermal history of the specimens. Transformations effected at low temperature persist on reheating.

538.221 : 539.23 **3671**

Magnetization Reversal in Thin Films.—R. L. Conger. (*Phys. Rev.*, 15th June 1955, Vol. 98, No. 6, pp. 1752–1754.) "An experiment has been performed which indicates that magnetization reversal in evaporated films of 80 percent Ni, 20 percent Fe, 2×10^{-5} cm thick takes place by domain rotation rather than by the motion of 180° domain walls."

538.221 : 669.24 **3672**

Nickel Alloys made by Powder Metallurgy Techniques.—(*Metallurgia, Manchr*, May 1955, Vol. 51, No. 307, pp. 215–217.) The close control in the production of Ni and Ni alloys by the technique described resulted in high-purity materials particularly suitable for use in valves. A magnetic alloy of composition Ni 77%, Fe 14%, Mo 4%, Cu 5%, was also developed; this can be annealed in pure or wet hydrogen without detriment to its magnetic properties. Initial permeabilities $>$ 25 000 have been obtained in strip material of thickness down to 0·0005 in.; by suitable heat treatment, the details of which are not given, this may be increased to 60 000–100 000. Tables are given of the electrical resistivity of various samples of high-purity Ni, of the mean coefficient of expansion of Ni-Fe alloys, and of the chemical composition of the materials discussed.

539.23 : 537.311.3 **3673**

Experimental Investigation of the Electrical Conductivity of Complex Metal/Dielectric Films produced by Evaporation.—C. Feldman. (*Ann. Phys., Paris*, May/June 1955, Vol. 10, pp. 435–478.) A study was made of films produced by (*a*) evaporating metal on to a previously deposited salt film, (*b*) evaporating metal and salt simultaneously, and (*c*) evaporating a salt on to a previously deposited metal film. The variation of conductivity with temperature and electric field is expressed by a formula of the same type as that for simple metal films, with different values of the constants. Theoretical discussion is based on the presence of very low potential barriers due to extremely close spacing between the grains. Complex films can be produced with either linear or nonlinear resistance characteristics. 49 references.

546.681 **3674**

Magnetic Susceptibilities of Crystal and of Liquid Gallium.—A. Marchand. (*C. R. Acad. Sci., Paris*, 1st Aug. 1955, Vol. 241, No. 5, pp. 468–470.) Experimental results are reported.

548.5 **3675**

On the Distribution of Impurity in Crystals Grown from Impure Unstirred Melts.—K. F. Hulme. (*Proc. phys. Soc.*, 1st July 1955, Vol. 68, No. 427B, pp. 393–399.)

621.315.61 : 546.287 **3676**

Silicones as Engineering Materials.—L. P. Smith. (*Engineering, Lond.*, 24th June 1955, Vol. 179, No. 4665, pp. 789–792.) The physical and chemical properties of silicones are briefly described and various applications are indicated.

621.318.2 **3677**

Impulse Magnetizer for Permanent Magnets.—G. M. Moore. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 121–123.) A 200-kA pulse is obtained by discharging a capacitor through a current step-up transformer. Reversal of the magnetizing pulse is prevented by use of a thyratron-controlled ignitron shunting the magnetizing loop. Application is to magnetron magnets.

666.1/.2 **3678**

The Devitrification Behaviour of Glasses Used in Vacuum Techniques.—O. Knapp. (*Acta tech. Acad. Sci. hungaricae*, 1954, Vol. 8, Nos. 1/2, pp. 67–78; *Glass Ind.*, May 1955, Vol. 36, No. 5, pp. 262–264 . . 285.) Experimental results indicate lower liquidus temperatures and higher rates of crystal growth for lime and lead glasses than were reported by Kalsing et al. (*Glastechn. Ber.*, 1943, Vol. 21, No. 3, p. 66.) The liquidus temperature for both types is about 825°–830°C.

MATHEMATICS

512 **3679**

A Direct Iterative Method for the Hurwitz Expansion of a Polynomial.—F. L. Bauer. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 285–290.)

517 **3680**

The Evaluation of Integrals containing a Parameter.—R. B. Dingle. (*Appl. sci. Res.*, 1955, Vol. B4, No. 6, pp. 401–410.) The problem considered is that of finding suitable expressions for the integral (*a*) for small and (*b*) for large values of a parameter. Methods based on (*a*) the Taylor expansion, (*b*) integration by parts, (*c*) Mellin transforms, and (*d*) the differential equation are expounded by evaluating the same function, $\mathrm{Ei}_n(x) = \int_1^\infty u^{-n} \mathrm{e}^{-xu}\, \mathrm{d}u$. The various expansions developed for $\mathrm{Ei}_n(x)$ are used in two following papers (not abstracted) on the functions $\mathrm{Ci}_n(x)$, $\mathrm{Si}_n(x)$, $\mathrm{CI}_n(x)$ and $\mathrm{SI}_n(x)$.

519.2 **3681**

A Sequential Two-Sample Life Test.—B. Epstein. (*J. Franklin Inst.*, July 1955, Vol. 260, No. 1, pp. 25–29.) Analysis is presented relevant to the problem of determining, from tests on samples, which of two lots of components has the greater mean life.

519.2 **3682**

An Introduction to Stochastic Processes, with Special Reference to Methods and Applications. [Book Review]—M. S. Bartlett. Publishers: University Press, Cambridge, 1955, 312 pp., 35s. (*Nature, Lond.*, 13th Aug. 1955, Vol. 176, No. 4476, p. 275.) Has application to communication theory.

MEASUREMENTS AND TEST GEAR

529.7 **3683**

Precision Measurement of Time.—H. M. Smith. (*J. sci. Instrum.*, June 1955, Vol. 32, No. 6, pp. 199–204.) A brief survey is given of methods and instruments used; the construction of chronometers is described and the application of standard-frequency transmissions is discussed.

53.082.7 : 535.22 : 538.56.029.6 **3684**

The Velocity of Propagation of Electromagnetic Waves.—J. T. Henderson & A. G. Mungall. (*Canad. J. Phys.*, June 1955, Vol. 33, No. 6, pp. 265–274.) Measurements were made by a coaxial-cavity-resonator method using a frequency of 400 Mc/s, which is close to that used for geodetic surveying in Canada. Consistent results were obtained giving a value of 299 780 km/s for *c*. This value is believed to be low owing to an indeterminate systematic error introduced by discontinuities at junctions in the cavity; coaxial-cavity methods are not considered capable of giving the desired degree of accuracy at this frequency.

53.082.7 : 535.22: 621.396.11.029.62 **3685**

A Measurement of the Velocity of Propagation of Very-High-Frequency Radio Waves at the Surface of the Earth.—E. F. Florman. (*J. Res. nat. Bur. Stand.*, June 1955, Vol. 54, No. 6, pp. 335—345.) An interferometer method was used, operating at a frequency of 172·8 Mc/s to avoid sky-wave interference and ground effects and to keep the size of the measuring system within convenient limits. The value derived for the free-space velocity was 299 795·1 ± 3·1 km/s; this uncertainty includes a 95% confidence interval for the mean and an estimated limit of ± 0·7 km/s for the systematic error. The accuracy of the result is limited by the accuracy with which the refractive index of the air path is known. See also *Tech. News Bull. nat. Bur. Stand.*, Jan. 1955, Vol. 39, No. 1, pp. 1–3.

621.3.018.41(083.74) + 529.786 **3686**

An Atomic Standard of Frequency and Time Interval.—L. Essen & J. V. L. Parry: E. C. Bullard. (*Nature, Lond.*, 13th Aug. 1955, Vol. 176, No. 4476, pp. 280–282.) Description of a frequency standard constructed at the National Physical Laboratory, based on a natural resonance of the Cs atom and using the atomic-beam magnetic-resonance technique. Using this standard, quartz clocks can be calibrated with an accuracy within ± 1 part in 10^9, corresponding to 0·0001 sec/day. The value of the frequency standardized is 9 192 632 050 ± 10 c/s. A note by Bullard is appended, discussing the desirability of abandoning the astronomical second in favour of a physically defined second.

621.3.018.41 (083.74) + 529.786 **3687**

Frequency and Time Standards.—F. D. Lewis. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1046–1068.) A review paper. Quartz-crystal resonators and stable oscillators including them are described. A discussion of the present status of atomic and molecular frequency standards includes the ammonia absorption cell and the ammonia- and caesium-beam oscillators. Instrumentation for precision frequency measurement is outlined and a current list of standard-frequency broadcasting stations is given.

621.317.3 : 621.385.2/.3].029.63 **3688**

Conductance and Slope Measurements on Transit-Time Diodes and Triodes.—F. W. Gundlach & H. Lonsdorfer. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 305–309.) Theory is given and methods are described for measuring the conductance of disk-seal diodes and the input conductance and transconductance of disk-seal triodes at about 50 cm and 12 cm λ. Some results are reported.

621.317.3 + 621.375.2 + 621.373.4].029.6 **3689**

Disc-Seal Circuit Techniques.—Swift. (See 3541.)

621.317.3.029.6 **3690**

Microwave Measurements.—G. Pircher. (*Rev. gén. Élect.*, June 1955, Vol. 64, No. 6, pp. 301–311.) A survey of up-to-date methods and equipment including standing-wave detectors, wavemeters, bolometers, attenuators and turntable apparatus for measurements on aerials.

621.317.335(083.7) **3691**

The Measurement of the Dielectric Constant of Standard Liquids.—L. Hartshorn, J. V. L. Parry & L. Essen. (*Proc. phys. Soc.*, 1st July 1955, Vol. 68, No. 427B, pp. 422–446.) Methods are described and results are presented for measurements on benzene, cyclohexane, dichlorethane and nitrobenzene, made with the object of providing dielectric-constant values of improved accuracy. Both audio and microwave frequencies were used.

621.317.336 **3692**

Rapid Measurement of Impedance and Admittance.—B. Salzberg & J. W. Marini. (*Elect. Engng, N.Y.*, June 1955, Vol. 74, No. 6, p. 503.) Digest of paper to be published in *Trans. Amer. Inst. elect. Engrs*, Part I, *Communication and Electronics*, 1955, Vol. 74. A method of determining the driving-point impedance of linear networks over the frequency range 50 kc/s–5 Mc/s involves measuring the resistive and reactive components by means of mixers whose local-oscillator voltage is derived from the current through the impedance while the voltage across the impedance is used as the signal voltage.

621.317.336 : 621.372 **3693**

Transmission-Line Termination.—Dukes. (See 3483.)

621.317.341 : 621.372.56 **3694**

Resistance Attenuator Circuits for Attenuation Measurements up to 20 Nepers.—R. Dallemagne. (*Câbles & Transm.*, July 1955, Vol. 9, No. 3, pp. 229–245.) Details are given of the construction and use of equipment for measurement of attenuation and crosstalk over the frequency band 5–800 kc/s. Correction of the effects of parasitic impedances due to wiring etc., in the attenuator used is simplified by representing them as T, Π, or lattice networks.

621.317.36 : 621.373.1.029.64 **3695**

Ammonia Absorption Line (3, 3) as Standard for Measurement of Frequencies in the 5–20-Mc/s Band with Accuracy of 10^{-6}.—B. D. Osipov & A. M. Prokhorov. (*C. R. Acad. Sci. U.R.S.S.*, 11th June 1955, Vol. 102, No. 5, pp. 933–934. In Russian.) Equipment using a Stark-modulated microwave spectroscope was used, the signal being suitably frequency-multiplied, to bring it into the 24-kMc/s band. A block diagram of the equipment is given.

621.317.382 : 621.396.61.029.62 **3696**

Measurement of Transmitter Power of the order of Tens of Watts at Metre Wavelengths.—R. Bryssinck & A. G. Tellier. (*Rev. HF, Brussels*, 1955, Vol. 3, No. 2, pp. 71–82.) Calorimetric, directional-coupler, peak-voltmeter and photometric methods of measurement are discussed and some results are reported. With these four methods the attainable accuracies are respectively within 2%, 5%, 8% and 10%, or 30% in the last case for low powers. With correctly designed loads the last three methods can be used satisfactorily.

621.317.44 : 537.311.33 : 546.682.86 : 538.632 **3697**

Indium Antimonide as a Fluxmeter Material.—E. W. Saker, F. A. Cunnell & J. T. Edmond. (*Brit. J. appl. Phys.*, June 1955, Vol. 6, No. 6, pp. 217–220.) The principles of measurement of magnetic fields by use of the Hall effect are considered. The efficiency of Hall-voltage generators is proportional to the square of the carrier mobility in the material used. The mobility for InSb is 60 000 cm/s per V/cm, compared with 3 600 cm/s per V/cm for Ge; the theoretically attainable output power of an InSb generator is therefore about 280 times that of a Ge generator. The construction of suitable probes is described and sensitivity, linearity, and temperature compensation are discussed.

621.317.7 **3698**

The Damping of Moving-Coil Vibrating Systems by means of Quadripole Resonant Circuits.—E. G. Schlosser. (*Arch. Elektrotech.*, 20th June 1955, Vol. 42, No. 1, pp. 42–47.) An arrangement of two resonant circuits is described, capable of providing optimum damping for recording instruments.

621.317.7.029.53/.55 **3699**

Broad - Band Reflectometers at High Frequencies.—R. T. Adams & A. Horvath. (*Elect. Commun.*, June 1955, Vol. 32, No. 2, pp. 118–125.) A directional coupler using resistive rather than reactive coupling elements has constant sensitivity over the frequency range 300 kc/s–30 Mc/s.

621.317.725.029.42 : 621.383.2 **3700**

A Photoelectric Relay for measuring Voltages of Low Frequency.—J. M. W. Milatz, H. J. J. van Boort, J. van Laar & C. T. J. Alkemade. (*Appl. sci. Res.*, 1955, Vol. B4, No. 6, pp. 447–456.) The instrument described is designed for amplifying and measuring signals such as bolometer outputs varying at a frequency of the order of 1 c/s, and comprises primary d.c. galvanometer, rotating-disk light chopper, and photocell coupled to 50-c/s amplifier, with a.c. galvanometer as indicator. The sensitivity is limited only by the Johnson noise of the input circuit; drift effects are very low.

621.317.729 **3701**

A Microwave Phase Contour Plotter.—J. S. Ajioka. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1088–1090.) A simple arrangement is described, using two field-sampling probes, one of which provides the reference signal.

621.317.733 **3702**

Measurement of Inductances, Capacitances and Frequencies.—W. Herzog & E. Frisch. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 325–328.) Descriptions are given of a bridge connected as oscillator, for measurement of inductances, and a passive bridge for measurement of capacitances and frequencies. Adjustment of a capacitance over a range 1 : 10 enables capacitances and inductances over a range 1 : 1000 and frequencies over a range 1 : 30 to be measured. See also 1107 of April (Herzog).

621.317.755 **3703**

Towards the Universal Oscillograph.—J. Croizier. (*Électronique, Paris,* July/Aug. 1955, Nos. 104/105, pp. 48–51.) Design principles are discussed for equipment for studying phenomena over a wide frequency range, having interchangeable timebase units together with a common unit comprising c.r. tube, output amplifiers and calibrating voltage.

621.317.755 **3704**

A Rapid and Simple Method for obtaining Permanent Records from Cathode-Ray Oscilloscopes.—H. D. Rathgeber. (*J. sci. Instrum.,* June 1955, Vol. 32, No. 6, pp. 232.) The c.r.o. image is traced with a ball-point pen on a removable strip of transparent plastic tape stuck on the screen.

621.317.755 : 778.6 **3705**

Colour Photography of Oscillograms.—G. H. Hille. (*Elektronik,* June 1955, Vol. 4, No. 6, pp. 129–130.) Technique is described for photographing in different colours curves displayed simultaneously on the c.r.o. screen.

621.317.784.029.6 **3706**

A Milliwattmeter for Centimetre Wavelengths.—A. C. Gordon-Smith. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 685–686.) "The instrument is in the form of a differential air thermometer, and consists of two similar glass cells connected by a glass capillary tube. A carbon-coated strip is placed in each of the two cells; one of these strips absorbs the radio-frequency power to be measured and the other is heated by direct current. A liquid pellet in the capillary tube is displaced as a result of the differential expansion of the air in the two cells arising from the heat dissipated in the carbon-coated strips. After balancing the system by adjustment of the d.c. cell the radio-frequency power is finally determined by the measurement of the d.c. power which must be substituted for the radio-frequency power in the same cell in order to maintain the state of balance. The instrument has been used to measure powers of 10 to 100 mW at a wavelength of 3 cm with a discrimination of about 0·2 mW."

621.317.794.029.64 **3707**

An Improved Method of measuring Efficiencies of Ultra-high-Frequency and Microwave Bolometer Mounts.—R. W. Beatty & F. Reggia. (*J. Res. nat. Bur. Stand.,* June 1955, Vol. 54, No. 6, pp. 321–327.) A method is described based on that of Kerns (3471 of 1949) but modified so as to avoid direct measurement of impedance.

621.396.62.001.4(083.7) **3708**

I.R.E. Standards on Radio Receivers: Method of Testing Receivers employing Ferrite Core Loop Antennas, 1955.—(*Proc. Inst. Radio Engrs,* Sept. 1955, Vol. 43, No. 9, pp. 1086–1088.) Standard 55 I.R.E. 17.S1.

621.397.6.001.4 : 535.623 **3709**

Differential Gain tests TV Color.—Schroeder. (See 3758.)

621.397.8.001.4 **3710**

Method for the Assessment and Characterization of the Distortion of the Sawtooth Test Signal in Tests on Television Transmission Lines.—Bödeker. (See 3767.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

621.317.39 : 534.13 **3711**

Use of λ/4 Coaxial Line for Measurement of Mechanical Oscillations.—E. Löb. (*Arch. Elektrotech.,* 20th June 1955, Vol. 42, No. 1, pp. 5–13.) The amplitude of vibration is determined by arranging the vibrating object near the open end of the line, so as to vary its electrical length periodically, and observing the corresponding periodic variations of tuning. Vibrations of nonmetallic as well as metallic objects can be investigated.

621.365.5 (083.74) **3712**

I.R.E. Standards on Industrial Electronics: Definitions of Industrial Electronics Terms, 1955.—(*Proc. Inst. Radio Engrs,* Sept. 1955, Vol. 43, No. 9, pp. 1069–1072.) Standard 55 I.R.E. 10.S1 on induction and dielectric heating.

621.384.6 **3713**

Strong Focusing in [particle] **Accelerators.**—W. Dällenbach. (*Z. angew. Phys.,* July 1955, Vol. 7, No. 7, pp. 344–360.) Full text of paper abstracted in 3059 of October.

621.384.611/.612 **3714**

The 156-in. Cyclotron at Liverpool.—M. J. Moore. (*Nature, Lond.,* 11th June 1955, Vol. 175, No. 4467, pp. 1012–1015.) The machine described is a synchrocyclotron producing protons of energy about 400 MeV.

621.384.611 **3715**

General Purpose X-Band Laboratory Microtron with Facilities for Electron Extraction.—H. F. Kaiser & W. T. Mayes. (*Rev. sci. Instrum.,* June 1955, Vol. 26, No. 6, pp. 565–567.)

621.384.612 **3716**

The Synchrotron and Problems relating to it.—E. Persico. (*J. Phys. Radium,* May 1955, Vol. 16, No. 5, pp. 360–365.) A short survey.

621.384.612 **3717**

Betatron Oscillations in the Synchrotron.—C. L. Hammer, R. W. Pidd & K. M. Terwilliger. (*Rev. sci. Instrum.,* June 1955, Vol. 26, No. 6, pp. 555–556.) Experimental results indicate that a transverse r.f. electric field will excite the betatron oscillations at several frequencies, the spacing of which is equal to the synchrotron frequency. The effect is believed to be due to frequency modulation of the betatron oscillations by the synchrotron oscillations.

621.384.612 **3718**

Experimental Characteristics of the Proton Synchrotron.—P. B. Moon, L. Riddiford & J. L. Symonds. (*Proc. roy. Soc. A,* 21st June 1955, Vol. 230, No. 1181, pp. 204–215.) Features of the Birmingham proton synchrotron which are important in relation to the experimental use of the machine are described.

621.384.612 **3719**

Some Proton Synchrotron Beam Studies with the Induction Electrode.—L. Riddiford, H. B. van der Raay & R. F. Coe. (*Proc. phys. Soc.,* 1st June 1955, Vol. 68, No. 426A, pp. 489–502.)

621.384.622.2 **3720**

The Linear Accelerator.—(*Elect. Rev., Lond.,* 24th June 1955, Vol. 156, No. 25, pp. 1144–1146.) A simplified explanation of the mode of operation.

621.385.833 **3721**

Third-Order Aberrations of a Typical Electrostatic Unipotential Lens.—W. Glaser & P. Schiske. (*Optik, Stuttgart*, 1955, Vol. 12, No. 5, pp. 233–245.)

621.387.424 **3722**

Sensitive Volume of External-Cathode Geiger-Müller Counters.—D. Blanc. (*Nuovo Cim.*, 1st June 1955, Vol. 1, No. 6, pp. 1280–1281. In French.)

621.389 : 539.155.082.7 **3723**

Recent Research with an Experimental Mass Spectrometer.—G. P. Barnard. (*J. Electronics*, July 1955, Vol. 1, No. 1, pp. 78–102.) Description of a precision all-metal instrument constructed at the National Physical Laboratory; it is a 60°-sector type, first-order, single-focusing, with 4-in. radius of curvature in the magnetic analyser.

PROPAGATION OF WAVES

538.566.2 **3724**

Reflection of a Plane Electromagnetic Wave by an Ionized Medium.—P. Poincelot. (*C. R. Acad. Sci., Paris*, 11th July 1955, Vol. 241, No. 2, pp. 186–188.) Expressions involving Hankel functions are derived for the strength of the electric and magnetic fields in a medium where the refractive index varies with altitude according to a stated law.

538.566.2 **3725**

Reflection of a Plane Electromagnetic Wave by an Ionized Gas with a Given Distribution Law.—P. Poincelot. (*C. R. Acad. Sci., Paris*, 18th July 1955, Vol. 241, No. 3, pp. 290–292.) Continuation of 3724 above. See also note of correction, *ibid.*, 29th Aug. 1955, Vol. 241, No. 9, pp. 649–651.

621.396.11 : 551.510.535 **3726**

Ionospheric-Absorption Equivalence Theorems.—É. Argence, K. Rawer & K. Suchy. (*C. R. Acad. Sci., Paris*, 1st Aug. 1955, Vol. 241, No. 5, pp. 505–507.) A more general analysis is presented than that of Appleton & Beynon (2400 of August); partial reflections and electron collisions are taken into account. The case of strong absorption is investigated using theory of dispersive media and metallic reflection.

621.396.11.029.55 **3727**

Simplification of the 'Spanish Method' [for ionospheric prediction of m.u.f.s].—R. Gea Sacasa. (*Rev. Telecomunicación, Madrid*, March 1955, Vol. 9, No. 39, pp. 31–51. In Spanish and English.) The monthly predictions published by the Commonwealth Observatory of Australia for the months of December and June, 1953 and 1954, are compared with those computed by the author's method. The results are similar, but in nearly all cases, and particularly in summer, the Spanish method predicts higher m.u.f.s than the Australian. By the use of a set of abacs developed by the author, predictions for any period of the year and for any locality and range may be very simply obtained.

621.396.11.029.6 **3728**

V.H.F. and U.H.F. Signals in Central Canada.—D. R. Hay & R. C. Langille. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, p. 1136.) Measurements are reported of signals at frequencies of 49, 91, 173 and 495 Mc/s, at ranges between 20 and 235 miles. The results are close to those predicted from theory of propagation round a smooth spherical earth [802 of 1948 (Bullington)] for ranges up to 30–40 miles. At ranges > 80 miles the deviations from the predicted value increase with increasing frequency. Assuming that at ranges > 80 miles the signals are propagated by scatter from atmospheric turbulence, the results are consistent with the scatter formula proposed by Gordon (1136 of April).

621.396.11.029.62/.63 **3729**

Factors affecting Radio Propagation in the TV and F.M. Bands.—W. E. Utlaut. (*Tele-Tech & Electronic Ind.*, June 1955, Vol. 14, No. 6, pp. 98–101 . . 378.) An account is presented of the effects at frequencies up to about 1 kMc/s of (*a*) diffraction by the earth and by obstacles, (*b*) atmospheric refraction, (*c*) atmospheric reflection, (*d*) scattering, and (*e*) the sporadic-E layer, with particular reference to recent theoretical and experimental work mainly by the Central Radio Propagation Laboratory.

621.396.11.029.62 **3730**

Long-Distance V.H.F. Fields: Part 1—Partial Reflections from a Standard Atmosphere. Part 2—Refractivity Profiles containing 'Sharp Layers'. Part 3—The Case of Two Elevated Layers.—F. H. Northover. (*Canad. J. Phys.*, May & June 1955, Vol. 33, Nos. 5 & 6, pp. 241–256 & 316–349.) Various explanations are discussed for the high field strengths of v.h.f. radio signals which have been consistently observed beyond the horizon. Detailed analysis indicates that the phenomenon cannot be explained solely in terms of partial internal reflections when the propagation takes place in a standard atmosphere, characterized by a continuous slow decrease of refractive index with height. While the phenomenon could be due to this cause when high-level inversion layers are present, scattering from atmospheric turbulence is considered a more probable cause. The general theory is used to derive an equation for the eigenvalues of the propagation for the case of two sharply defined atmospheric layers.

621.396.11.029.62 : 53.082.7 : 535.22 **3731**

A Measurement of the Velocity of Propagation of Very-High-Frequency Radio Waves at the Surface of the Earth.—Florman. (See 3685.)

621.396.81.029.62 **3732**

Note on the Diurnal Variation of Field Strength in the U.S.W. Band.—L. Klinker. (*Z. Met.*, June 1955, Vol. 9, No. 6, pp. 178–191.) Diurnal variations are discussed associated with the night-time formation of low-level inversion and its disappearance during the day. For transmission distances up to twice the optical path length the effect can be accounted for by variations of atmospheric refraction. Using measurements of the vertical gradients of temperature and water-vapour pressure, a calculation is made of the daily variation from the known formula for field strength. For average conditions, the calculated value is brought into agreement with observations by taking account of the temperature gradient only. For longer distances the observed and calculated values differ by an amount which increases with the path length, since the effect of refraction decreases relative to that of other factors, notably scattering due to turbulence.

621.396.812.3 **3733**

Distribution-in-Speed of Fading of 150-kc/s Waves.—R. B. Banerji. (*Nature, Lond.*, 16th July 1955, Vol. 176, No. 4472, p. 131.) Fading observations were made at the Pennsylvania State University, using time intervals much longer than those used e.g. by Mitra at Cambridge working with frequencies of 2–6 Mc/s (442 of 1950). No significant deviation from a Gaussian distribution of speed of fading was found; this supports the theoretical prediction that such a deviation should be less readily evident at low than at high frequencies.

621.396.11 : 551.510.535 **3734**

The Physics of the Ionosphere. [Book Notice]—(See 3614.)

RECEPTION

621.396.62 **3735**

Cross-Section of the Technical Novelties of [West German] **1955/56 Broadcast Receivers.**—W. W. Diefenbach. (*Funk-Technik, Berlin,* July 1955, Vol. 10, No. 13, pp. 352–356.) The principal trends include developments in u.s.w./f.m. and l.f. stages, use of rotatable ferrite-rod built-in aerials, and use of several loudspeakers of both moving-coil and e.s. types in the larger table models. Further details are given in a supplement and in subsequent issues of the journal.

621.396.62.001.4 (083.74) **3736**

I.R.E. Standards on Radio Receivers: Method of Testing Receivers employing Ferrite Core Loop Antennas, 1955.—(*Proc. Inst. Radio Engrs,* Sept. 1955, Vol. 43, No. 9, pp. 1086–1088.) Standard 55 I.R.E. 17.S1.

621.396.621 : 621.396.822 **3737**

The Resolution of Signals in White, Gaussian Noise.—C. W. Helstrom. (*Proc. Inst. Radio Engrs,* Sept. 1955, Vol. 43, No. 9, pp. 1111–1118.) "The resolution of two signals of known shapes $F_1(t)$ and $F_2(t)$ in white Gaussian noise is treated as a problem in statistical decision theory. The observer must decide which of the signals is present with a minimum probability of error. The optimum system for this decision is specified in terms of filters matched to the two signals, the outputs of which are compared. The error probability is exhibited as a function of the cross-correlation of the two signals and of the signal-to-noise ratio. If the phases of the two signals are unknown, as in radar, and if the signals are of equal strength and equal *a priori* probability, the optimum system consists of filters matched to each of the signals, each followed by a detector. The observer then bases his decision upon which of the detectors has the larger output. The probability of error is computed for this case also."

621.396.621.54 : 621.319.43 : 537.227 **3738**

The Application of Dielectric Tuning to Panoramic Receiver Design.—T. W. Butler, Jr, W. J. Lindsay & L. W. Orr. (*Proc. Inst. Radio Engrs,* Sept. 1955, Vol. 43, No. 9, pp. 1091–1096.) Continuous tuning over a 2 : 1 frequency band is obtained at frequencies up to 110 Mc/s by using ferroelectric tuning capacitors with nonlinear characteristics.

621.396.81 : 621.396.67 **3739**

The Limits of Communication Reception using Aerials with Losses.—Didlaukis. (See 3494.)

STATIONS AND COMMUNICATION SYSTEMS

621.376.5 : 621.39 **3740**

Quantitative Noise Reduction in Pulse Time Modulation.—J. Das. (*Electronic Engng,* Sept. 1955, Vol. 27, No. 331, pp. 406–409.) Rigorous analysis of typical systems, based on the principles proposed by Deloraine & Labin (1947 of 1945), gives results for improvement of signal/noise ratio in agreement with experiment.

621.39.001.11 : 519.2 **3741**

On the Average Uncertainty of a Continuous Probability Distribution.—A. D. du Mosch. (*Appl. sci. Res.,* 1955, Vol. B4, No. 6, pp. 469–473.) Discussion of importance in communication theory.

621.395.2 : 621.374.4 : 621.375.3.029.3 **3742**

All-Magnetic Audio Amplifier.—Suozzi & Hooper. (See 3537.)

621.395.44 : 621.315.28 **3743**

A Transatlantic Telephone Cable.—M. J. Kelly, G. Radley, G. W. Gilman & R. J. Halsey. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 717–719.) Discussion on 1547 of June.

621.396 **3744**

The Argentine Telecommunications Networks.—H. B. R. Boosman. (*Tijdschr. ned. Radiogenoot.,* May 1955, Vol. 20, No. 3, pp. 115–135. In English.) See 2745 of September.

621.396.3 **3745**

The T.O.R. [teletype-on-radio] **Circuits for the Argentine Radio Links.**—W. Six. (*Commun. News,* Aug. 1955, Vol. 15, No. 4, pp. 108–119; *Tijdschr. ned. Radiogenoot.,* May 1955, Vol. 20, No. 3, pp. 137–159. In English.) Application of the error-reducing system described by van Duuren (2837 of 1951) to the Argentine radiotelegraph system (3744 above). Most of the switching is performed by means of cold-cathode tubes Types Z500T and Z501T. A radio test on a circuit between Hilversum and Eindhoven showed that introduction of the T.O.R. system reduced the number of mutilated characters by a factor of 2 000.

621.396.65.029.64 **3746**

Radio Link Operating in 4 000 Mc/s Band, for Television and Multichannel Telephony.—H. C. B. Evertsz. (*Tijdschr. ned. Radiogenoot.,* May 1955, Vol. 20, No. 3, pp. 183–193. In English.) Description of link equipment using Type-EC56 triodes for mixing and amplifying at frequencies in the 3·8–4·2-kMc/s band. Heterodyne repeater stations are used. Some details are given of the aerial system, which comprises a parabolic reflector illuminated by a square waveguide continued as a pair of rectangular waveguides, one leading to the transmitter and the other to the receiver and each containing a 'uniline' control device operated by ferromagnetic resonance in a small sheet of ferrite.

SUBSIDIARY APPARATUS

621-526 **3747**

The Response of Remote-Position-Control Systems with Hard-Spring Nonlinear Characteristics to Step-Function and Random Inputs.—J. C. West & P. N. Nikiforuk. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 575–593. Discussion, pp. 594–595.)

621-526 **3748**

The Adjustment of Control Systems for Quick Transient Response.—A. T. Fuller. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 596–601.) A theoretical investigation indicates that for a large class of linear systems the error due to a transient disturbance is dependent on only one system parameter, the 'settling time-constant', and that the quickest approach to correction is obtained when the system is adjusted so as to be quasicritically damped. The adoption of quasicritical damping as a design criterion for stability is recommended.

621-526 **3749**

The Integral-of-Error-Squared Criterion for Servo Mechanisms.—H. H. Rosenbrock. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 602–607.)

621.314.63 : 621.311.6 **3750**

Silicon Alloy Junction Diodes for Power Supply Applications.—J. Shields. (*Engineer, Lond.,* 10th June 1955, Vol. 199, No. 5185, pp. 801–803; *B.T.-H. Activ.,* July/Aug. 1955, Vol. 26, No. 4, pp. 102–107.) Characteristics of low-power and high-power Si diodes are presented and various applications indicated.

TELEVISION AND PHOTOTELEGRAPHY

621.397.24 : 621.397.6 **3751**

An Unconventional Wired Television Distribution System.—E. J. Gargini. (*J. Telev. Soc.*, April/June 1955, Vol. 7, No. 10, pp. 403–427.) The advantages and disadvantages of radio and wired television systems are compared. Tests of the suitability of various types of cable for multichannel operation are mentioned. Various distribution-network arrangements are considered; good area coverage is obtained by use of a network comprising spiral main feeder sections with short spurs. A detailed description is given of a wired system in which receiver design is simplified by transferring as much circuitry as possible to the sending end. See also 1173 of April.

621.397.26 **3752**

Long-Range Television Reception.—(*Wireless World*, Oct. 1955, Vol. 61, No. 10, pp. 504–505. Correction, *ibid.*, Nov. 1955, Vol. 61, No. 11, p. 530.) Good reception has been recorded in Sweden of television broadcasts on 48, 55 and 62 Mc/s from Russia, Italy, etc.

621.397.26 : 621.396.65 **3753**

The Roving Eye.—T. Worswick & G. W. H. Larkby. (*J. Telev. Soc.*, April/June 1955, Vol. 7, No. 10, pp. 397–400.) Description of the B.B.C. mobile television-camera unit. A frequency of about 200 Mc/s is used for the vision-signal radio link to base; four-element Yagi aerial arrays are used both on the vehicle and at the base; arrangements for keeping the vehicle aerial on the correct bearing are described. Positive modulation is used, the transmitter power being about 12 W on peak white. In open country the range is of the order of two miles, the limit being set by man-made interference. In built-up areas the range may be anything up to a mile, depending entirely on topography.

621.397.26 : 621.396.65.029.64 **3754**

The Manchester-Kirk o'Shotts Television Radio-Relay System.—G. Dawson, L. L. Hall, K. G. Hodgson, R. A. Meers & J. H. H. Merriman. (*Proc. Instn elect. Engrs*, Part B, Sept. 1955, Vol. 102, No. 5, pp. 607–608.) Discussion on 2784 of 1954.

621.397.5 **3755**

Television Technique.—A. Karolus. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st May 1955, Vol. 33, No. 5, pp. 169–186. In German.) An account, intended for nonspecialists, of the historical development of television.

621.397.5 **3756**

Limits of Quality with Intercarrier Sound Reception.—H. J. Griese. (*Fernmeldetech. Z.*, July 1955, Vol. 8, No. 7, pp. 374–378.) Sources of noise on the intercarrier system are examined. Transmitter tests necessary for investigating interference phase modulation are discussed. Most of the audio interference observed originates in the receiver rather than the transmitter. The less stringent requirements as regards oscillator-frequency constancy and avoidance of microphony with the intercarrier system make this system greatly preferable for operation in bands III and IV.

621.397.6.001.4 **3757**

Determination of the Characteristic Parameters of a Television F.M. Link by Measurements between Video Input and Video Output.—G. Brühl. (*Fernmeldetech. Z.*, July 1955, Vol. 8, No. 7, pp. 362–366.) Methods of measurement for both video and r.f. parts of the system are discussed. In order to ascertain which part is responsible for observed imperfections of reproduction, the amplitude and frequency of the test signals should be appropriately chosen, and the sequence of the operations should be: (*a*) linearity measurement of the video stages, using very low frequencies, and any necessary corrections; (*b*) measurement and adjustment of the frequency characteristic of the r.f. stages; (*c*) measurement of overall frequency and delay characteristics.

621.397.6.001.4 : 535.623 **3758**

Differential Gain tests TV Color.—J. O. Schroeder. (*Electronics*, Aug. 1955, Vol. 28, No. 8, pp. 114–117.) A composite signal, consisting of a small-amplitude 3·5-Mc/s sine wave mixed with a large-amplitude 120-c/s rectangular wave of variable duty cycle, is used to check the linearity of the transfer characteristic of video equipment.

621.397.61 + [621.396.61 : 621.376.3 **3759**

General Outline of the Development of Transmitters for Television and Frequency Modulation [in the Netherlands].—P. W. L. v. Iterson & H. A. Teunissen. (*Tijdschr. ned. Radiogenoot.*, May 1955, Vol. 20, No. 3, pp. 207–222. In English.)

621.397.61 : 621.372.55 **3760**

Application of Differential Equalization in Television.—R. Theile. (*Arch. elekt. Übertragung*, June 1955, Vol. 9, No. 6, pp. 247–254.) A development of Gouriet's equalization method (1936 of 1953) is described. A simple equalizer circuit is used; its performance is shown by oscillograms and photographs of a test pattern.

621.397.61 : 621.372.55 **3761**

Circuit for Aperture Compensation in Television Cameras.—W. Dillenburger. (*Frequenz*, June 1955, Vol. 9, No. 6, pp. 181–188.) Phase-linear amplitude equalizers permitting 100% modulation of the video signal at frequencies up to 5 Mc/s are discussed, including various differentiating equalizers and the 'cosine' equalizer. Use of aperture compensation is scarcely worth while if the uncompensated camera gives a modulation depth of 50% or more at 5 Mc/s. See also 3104 of October.

621.397.611.2 **3762**

Limiting Resolution due to Charge Leakage in the Scenioscope, a New Television-Camera Tube.—P. Schagen. (*Philips Res. Rep.*, June 1955, Vol. 10, No. 3, pp. 231–238.) The loss of modulation depth in the picture signal due to charge leakage is calculated as a function of the resistivity and thickness of the glass target. Estimates show that for practical applications the resistivity should be $> 2{\cdot}3 \times 10^{11}$ Ω.cm. In a 625-line system the diameter of a picture element is about 75 μ with a scanned target area of 45×60 mm²; in order to obtain satisfactory resolution the target thickness must not exceed 100 μ.

621.397.62 (94) **3763**

Television Channels, Standard Intermediate Frequencies and Standards for Limits of Radiation from Receivers.—(*Proc. Instn Radio Engrs Aust.*, June 1955, Vol. 16, No. 6, pp. 173–175.) A statement prepared by the Australian Broadcasting Control Board for the information of television-receiver manufacturers. Ten v.h.f. and 50 u.h.f. channels, each of 7 Mc/s, have been allocated. Sound i.f. should be 30·5 Mc/s ± 0·25

Mc/s, vision i.f. should be 36 Mc/s ± 0·25 Mc/s. Limits are stated for radiation due to beat oscillators; it has not yet been found practicable to recommend limits for radiation due to sweep circuits.

621.397.62 + 778.5] : 535.6 **3764**

Color Television vs. Color Motion Pictures.—D. G. Fink. (*J. Soc. Mot. Pict. Telev. Engrs*, June 1955, Vol. 64, No. 6, pp. 281–290.) The technical capabilities and limitations of the two systems are compared under five headings: (*a*) the viewing situation, (*b*) image photometry, (*c*) colorimetry, (*d*) structure, and (*e*) continuity. The results of a survey of 8-mm, 16-mm, and 35-mm film practice are tabulated and compared with the contemporary performance of 21-in. colour television receivers. The conclusions are also tabulated.

621.397.62 : 621.385.3.029.62/.63 **3765**

A U.H.F.-V.H.F. Television Tuner using Pencil Tubes.—W. A. Harris & J. J. Thompson. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 281–292.) The resonance frequencies of the experimental pencil-type triodes used are high enough to permit use of shunt-tuned circuits, and the feedback inductance is low enough to ensure stability. Advantages of shunt-tuning are the small overall dimensions and the moderate number of switching components required.

621.397.62.029.62 **3766**

A Survey of Tuner Designs for Multichannel Television Reception.—D. J. Fewings & S. L. Fife. (*J. Brit. Instn Radio Engrs*, Aug. 1955, Vol. 15, No. 8, pp. 379–404.) The survey includes designs of British, U.S. and European origin; a rotary-coil-turret design developed in the U.S. appears to be most generally suitable. Noise considerations are discussed; calculations indicate that optimum conditions are obtained with a receiver noise factor of 22 db at 40 Mc/s decreasing to 3 db at 220 Mc/s; the importance of these considerations for fringe-area reception is emphasized. Arrangements enabling existing single-channel receivers to operate for multichannel reception without use of double heterodyning are described. Future requirements for u.h.f. reception in the U.K. are discussed and tuner designs incorporating lumped and distributed tuning elements are examined.

621.397.8.001.4 **3767**

Method for the Assessment and Characterization of the Distortion of the Sawtooth Test Signal in Tests on Television Transmission Lines.—H. Bödeker. (*Fernmeldetech. Z.*, June 1955, Vol. 8, No. 6, pp. 323–324.) The fidelity with which the sawtooth level-setting signal is transmitted is tested by comparing the received sawtooth signal as displayed on a c.r.o. screen with engraved markings on a transparent template arranged just in front of the screen.

TRANSMISSION

621.396.61 : 621.376.3] + 621.397.61 **3768**

General Outline of the Development of Transmitters for Television and Frequency Modulation [in the Netherlands].—P. W. L. v. Iterson & H. A. Teunissen. (*Tijdschr. ned. Radiogenoot.*, May 1955, Vol. 20, No. 3, pp. 207–222. In English.)

621.396.61 : 621.396.662 **3769**

Automatic Tuning of Transmitters.—W. L. Vervest. (*Tijdschr. ned. Radiogenoot.*, May 1955, Vol. 20, No. 3, pp. 195–206. In English.) Description of the instantuner system. Automatic changing from one preset frequency to another is accomplished in 1–3 sec for small transmitters and in 2–10 sec for large transmitters.

621.396.61.029.63 : 621.385.4 **3770**

A Novel Ultra-high-Frequency High-Power-Amplifier System.—L. L. Koros. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 251–280.) The amplifier was developed for television transmitters and uses grid-driven 15-kW beam power tetrodes Type 6448 described by Bennett in *Trans. Inst. Radio Engrs*, March 1955, No. PGBTS-1, pp. 11–17, developed from the Type 6181 described previously by Bennett & Kazanowski (1206 of 1953). The anode cavity resonator is of transmission-line type, consisting essentially of one high-impedance and one low-impedance $\lambda/4$ section; it acts as a step-down transformer between valve and load.

VALVES AND THERMIONICS

621.314.63 **3771**

The Determination of the Dynamic Properties of Crystal Diodes.—G. Stuart-Monteith. (*Brit. J. appl. Phys.*, July 1955, Vol. 6, No. 7, pp. 254–256.) The a.c. characteristics of a forward-biased crystal diode depend on the frequency and the amplitude of the applied voltage. A method is given for determining the dynamic resistance for low values of bias current.

621.314.632 : 546.289 : 621.374 **3772**

Germanium Positive-Gap Diode: New Tool for Pulse Techniques.—A. H. Reeves & R. B. W. Cooke. (*Elect. Commun.*, June 1955, Vol. 32, No. 2, pp. 112–117.) English version of 2257 of 1954 (Reeves).

621.314.7 **3773**

A Simple Explanation of Transistor '*h*' Parameters.—L. B. Johnson. (*Mullard tech. Commun.*, July 1955, Vol. 2, No. 13, pp. 58–63.) The small-signal performance of transistors can be calculated from hybrid or '*h*' parameters which are given by the slopes of the characteristic curves at the working point. This mode of assessment is likely to be used extensively in manufacturers' published data. An indication is given of the use of these parameters for calculations on complex circuits.

621.314.7 **3774**

High-Frequency Power Gain of Junction Transistors.—R. L. Pritchard. (*Proc. Inst. Radio Engrs*, Sept. 1955, Vol. 43, No. 9, pp. 1075–1085.) Different ways of defining power gain at high frequencies are discussed. An equation is presented for calculating the gain in terms of the quadripole parameters of the transistor driven by a generator with purely resistive impedance. Secondly, an expression is derived relating the gain to the fundamental device parameters for transistors in which the base impedance is frequency dependent, as in grown-junction transistors. Measurements on about 60 grown-junction transistors on the whole confirm the theory. Thirdly, the gain of an idealized model of a grown-junction transistor is calculated from the physical parameters. The results indicate that it should be possible to obtain a gain of 30 db at 5 Mc/s and that these transistors should oscillate at frequencies up to several hundred Mc/s.

621.314.7 **3775**

Emitter Efficiency of Junction Transistor.—T. Misawa. (*J. phys. Soc. Japan*, May 1955, Vol. 10, No. 5, pp. 362–367.) The efficiency is calculated on the basis of the quasi-Fermi-level concept, by introducing modified boundary conditions appropriate to the case of moderately high injection level. The results are compared with those of Webster (2798 of 1954) and of Rittner (3390 of 1954).

621.314.7 **3776**

A Germanium Point-Contact Transistor to operate at High Ambient Temperatures.—A. F. Gibson, J. W. Granville & W. Bardsley. (*Brit. J. appl. Phys.*, July **1955**, Vol. 6, No. 7, pp. 251–254.) The process of carrier exclusion, previously termed 'carrier extraction' [2017 of July (Arthur et al.)], is applied in specially constructed transistors to suppress the normal increase of minority carriers with temperature, thereby increasing the upper temperature limit of the transistor by about 30°C and improving the speed of operation. The sweep current required has no effect on the noise factor. The technique may be applied to junction diodes, but not to junction transistors.

621.314.7(47) **3777**

Technical Data on Russian Transistors.—(*Radio, Moscow*, June 1955, No. 6, p. 30.) Data are tabulated for eight point-contact and seven junction-type transistors.

621.314.7 : 537.311.33 **3778**

Semiconductors and Transistors: some Current Problems.—J. R. Tillman. (*Nature, Lond.*, 2nd July **1955**, Vol. 176, No. 4470, pp. 9–11.) A concise survey of the existing state of knowledge.

621.314.7 : 546.28 **3779**

Forming Procedures for Silicon Point-Contact Transistors.—J. W. Granville, W. Bardsley & A. F. Gibson. (*Brit. J. appl. Phys.*, June **1955**, Vol. 6, No. 6, pp. 206–210.) Suitable whisker materials for use as emitters and collectors on *n*- and *p*-type Si and the pulsing techniques used in forming are described. Si transistors have been made with power gains not markedly inferior to those of Ge point-contact transistors. Experimentally determined characteristics are given. For a different method of forming, see **1195** of April (Jacobs et al.).

621.314.7 : 621.375.4 **3780**

Transistor Equivalent Circuits.—W. T. Cocking. (*Wireless World*, July–Oct. **1955**, Vol. 61, Nos. 7–10, pp. 331–334, 388–392, 444–448 & 499–502.) The principles for developing equivalent circuits of the thermionic valve are described and applied to the directly analogous *n-p-n* transistor with earthed emitter, leading on to the case of the earthed-base transistor. Equivalent circuits for transistor amplifiers are discussed, and formulae defining performance are deduced.

621.314.7 : 621.396.822 **3781**

Experimental Investigation and Separation of Noise Sources in Junction Transistors.—W. Guggenbühl & M. J. O. Strutt. (*Arch. elekt. Übertragung*, June **1955**, Vol. 9, No. 6, pp. 259–269.) Analysis of equivalent quadripoles shows that in the frequency-independent range the noise of a *p-n-p* transistor can be completely accounted for by (*a*) emitter-junction shot noise, (*b*) base-resistance noise, (*c*) collector saturation noise, and (*d*) current partition noise. The noise factors for the three basic transistor circuits are nearly equal. Results show that the noise factors of modern junction transistors are of the same order as those in good triode valves operating under comparable conditions. The noise factors of transistors Type OC70, OC71, and OC601 determined experimentally by a method described previously (**2778** of September) are presented graphically as a function of frequency.

621.385 : 621.317.723 **3782**

Receiving Tubes with Very Small Grid Current.—H. Takayama & K. Shimoda. (*J. phys. Soc. Japan*, May **1955**, Vol. 10, No. 5, pp. 387–391.) The use of miniature valves for electrometer purposes is discussed. Types 6AK5 and 3S4 are found to be appropriate. The grid current of the latter has been reduced to about 10^{-15} A by appropriate silicone treatment, a voltage gain of 20–40 being obtained.

621.385.002.2 **3783**

Materials for Radio Valves.—R. L. Smith-Rose. (*Nature, Lond.*, 11th June **1955**, Vol. 175, No. 4467, pp. 1029–1030.) Report of a discussion at the Institution of Electrical Engineers.

621.385.013.78.71 **3784**

The Thermally Conducting Valve Screen.—N. G. Webb. (*Marconi Instrumentation*, June **1955**, Vol. 5, No. 2, pp. 38–41.) A toroidal coil spring is fitted inside a screening can so that it encircles and makes contact with the hottest part of the valve envelope. The can screws on to a threaded metal bush on the valve holder or a metal screening box. A helical compression spring in the top of the can retains the valve in its holder. A bulb temperature of 220°C in free air was reduced to 130°C by this means.

621.385.029.6 **3785**

On the Initial Space-Charge Distribution in a Cylindrical Magnetron Diode.—R. Q. Twiss. (*J. Electronics*, July **1955**, Vol. 1, No. 1, pp. 1–7.) Calculations are made taking account of thermal emission velocities but neglecting electron-electron interactions. The space-charge distribution is of double-stream type even when the ratio of the radius of the space-charge cloud to the cathode radius is less than 2. Comparison of the results with experimental data (**3786** below) indicates that the stream theory does not describe the steady-state distribution.

621.385.029.6 **3786**

The Space Charge Distribution in the Pre-oscillation Magnetron.—L. E. S. Mathias. (*J. Electronics*, July **1955**, Vol. 1, No. 1, pp. 8–24.) An experimental study has been made of smooth-anode cylindrical magnetrons with anode-radius/cathode-radius ratios of 2–2·5, using molecular-beam technique. The space-charge density falls off with increasing distance from the cathode, at first smoothly and then in a series of small steps beyond the cloud radius predicted by stream theories. The space charge has no definite edge. Increasing the anode voltage increases the radius of the cloud and the density at each point in the space charge. Discrepancies between these results and those given by theory are discussed by Twiss (**3785** above).

621.385.029.6 **3787**

Theory of the Pre-oscillating Magnetron: Part 1.—D. Gabor & G. D. Sims. (*J. Electronics*, July **1955**, Vol. 1, No. 1, pp. 25–34.) A discussion is presented which may be of interest for a general understanding though not necessarily for a quantitative explanation of pre-oscillations in the cylindrical magnetron.

621.385.029.6 **3788**

The Effect of Initial Noise Current and Velocity Correlation on the Noise Figure of Traveling-Wave Tubes.—S. Bloom. (*RCA Rev.*, June **1955**, Vol. 16, No. 2, pp. 179–196.) The effect of correlation between fluctuation due to shot noise and that due to electron-velocity distribution is to introduce a further noise-current space-charge wave. Neither the degree of initial correlation nor the individual values of the shot-noise and velocity-distribution fluctuations affect the conditions for minimizing the noise figure of the valve, which depends only on the standing-wave ratio of the resultant noise-current wave and the position of the helix with respect to this wave.

621.385.029.6 **3789**

The 4-cm-λ Travelling-Wave Valve developed at the Centre National d'Études des Télécommunications.—Bobenrieth, Cahen, Lestel & Picquendar. (*Électronique, Paris,* May 1955, No. 102, pp. 15–23.) Details are given of the Type-S47 valve developed by the French Post Office for use in radio links branching from the main 8-cm-λ links. Output is $>$ 1 W and practically independent of frequency over the band 6–8·5 kMc/s; gain is of the order of 40 db, and operating voltage is 1 350 ± 30 V.

621.385.029.6 : 537.533 **3790**

Some Experiments on a Cylindrical Electron Beam Constrained by a Magnetic Field.—J. D. Lawson. (*J. Electronics,* July 1955, Vol. 1, No. 1, pp. 43–52.) Measurements were made of longitudinal variations of beam cross-section and radial current distribution, using a movable intercepting screen. The influence of angle of entry into the constraining axial magnetic field was studied. Operating parameters giving the smallest beam-diameter variations were: beam voltage 500 V, beam current 12 mA, beam radius about 1·2 mm, magnetic field 140 oersted. Discrepancies between the results and predictions from theory are discussed.

621.385.029.63 **3791**

Factors in the Design of Power Amplifiers for Ultra-high Frequencies.—J. Dain. (*J. Electronics,* July 1955, Vol. 1, No. 1, pp. 35–42.) Amplifier valves for the frequency range 400–900 Mc/s with outputs $>$ 10 kW and power gains not much less than 10 are discussed. The relative merits of triodes, tetrodes, klystrons and travelling-wave valves are compared.

621.385.029.64 **3792**

High-Gain Travelling-Wave Output Valve with Permanent Magnet.—W. Eichin, P. Meyerer, W. Veith & O. Zinke. (*Fernmeldetech. Z.,* July 1955, Vol. 8, No. 7, pp. 369–373.) Description of the Type-V503 valve, which gives linear operation with gain $>$ 30 db at a power output $>$ 3 W over the frequency range 3·6–4·2 kMc/s. The reflection factor at the input is $<$ 10% and at the output $<$ 5% over a 30-Mc/s band. Helix voltage is 1·3 kV and beam current about 35 mA. The cathode has a diameter of 8 mm, and the gun focusing is assisted by a permanent magnet, the resulting concentration being such that $<$ 1 mA is intercepted by the helix.

621.385.032.213.2 **3793**

The Bolt Cathode: an Indirectly Heated Tungsten Cathode for Electron Guns.—E. B. Baş. (*Z. angew. Phys.,* July 1955, Vol. 7, No. 7, pp. 337–344.) The heavy-duty cathode described comprises a tungsten rod with a coaxial external helical heater. One of the end faces of the rod is the emitter surface. Additional heating of the rod is obtained by electron bombardment from the heater. A magnetically stabilized heating circuit is used. Operating conditions were investigated experimentally. Results are presented graphically and discussed.

621.385.032.216 **3794**

The Resistance of the Oxide-Coated Cathode at Ultra-high Frequencies.—L. J. Herbst & J. E. Houldin. (*Brit. J. appl. Phys.,* July 1955, Vol. 6, No. 7, pp. 236–238.) Measurements were made on disk-seal triodes over the frequency range 730 Mc/s–2·360 kMc/s with cathode temperatures from 1 250° to 1 400°K. The cathode behaviour can be represented by the equivalent circuit comprising the grid-cathode capacitance in series with the coating resistance. Accurate determination of the d.c. coating resistance is not possible; the results agree approximately with those at r.f. Determinations correspond to specific conductivities between 0·3 and $0{\cdot}4\,\Omega^{-1}\mathrm{m}^{-1}$, at a temperature of 1 250°K. Heater resistance decreases with increasing cathode temperature and this effect can be used to measure power loss in the coating under oscillatory conditions.

621.385.032.216 **3795**

Mass-Spectrometer Investigation of Gases in Electronic Apparatus with Oxide Cathodes.—N. D. Morgulis & G. Ya. Pikus. (*C. R. Acad. Sci. U.R.S.S.,* 21st June 1955, Vol. 102, No. 6, pp. 1103–1106. In Russian.) The gas in an evacuated tube containing a heated oxide cathode was analysed at intervals up to 300 hours, and at the end of the subsequent period of about 330 hours. The latter analysis showed a large increase in the H_2 and He content. This was probably due to a diffusion of these gases through the molybdenum-glass envelope. Other gases observed were H_2O, O, O_2 and $N_2 + CO$. Results are presented graphically.

621.385.032.216 **3796**

A Study of the Long-Term Emission Behaviour of an Oxide-Cathode Valve.—G. H. Metson. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 657–675. Discussion, pp. 675–677.) Conditions for maintaining emission over a long period are discussed; it is assumed that emission is maintained as long as there is a sufficiency of metallic Ba in the oxide matrix. Factors causing loss or gain of the Ba metal are examined. The tentative conclusion is that a cathode working under a current load in gas-free surroundings will continue to emit until the BaO matrix is exhausted by electrolysis and evaporation.

621.385.032.216 : 621.315.612.8 **3797**

Some Experiments on the Breakdown of Heater-Cathode Insulation in Oxide-Cathode Receiving Valves.—G. H. Metson, E. F. Rickard & F. M. Hewlett. (*Proc. Instn elect. Engrs,* Part B, Sept. 1955, Vol. 102, No. 5, pp. 678–683.) The sintered alumina used for insulating the tungsten-wire heater is more liable to failure when the heater is run positive with respect to the cathode than when it is run negative, due to enhanced transfer of the tungsten across the alumina. The effect is attributed to production of positive tungsten ions under electron bombardment from the cathode, and is retarded when the alumina contains a pore-free layer.

621.385.032.24.002.2 **3798**

Frame-Grid Technique and its Significance in the Construction of Modern Amplifier Valves.—O. Pfetscher. (*Elektronik,* June 1955, Vol. 4, No. 6, pp. 139–143.)

621.385.15 **3799**

Anode-Dynode Beam Deflection Amplifier.—H. J. Wolkstein & A. W. Kaiser. (*Electronics,* Aug. 1955, Vol. 28, No. 8, pp. 132–136.) The valve described has a composite output element such that in the absence of an applied signal the anode and dynode currents are out of phase and cancel. Signal variations produce currents in each element which are in phase, resulting in a linear input-voltage/output-current characteristic. Linear negative or positive transconductance can be produced. Applications to gating circuits, difference amplifiers, binary storage circuits etc., are described.

621.385.15 : 621.373.4.029.6 **3800**

Transit-Time Functions of a Dynatron Oscillator.—G. Diemer. (*Appl. sci. Res.*, 1955, Vol. B4, No. 6, pp. 457–463.) A new type of dynatron valve is discussed in which the primary electrons are directed obliquely towards the secondary-emission electrode. High values of the negative dynode admittance are attained by using a primary-electron voltage such that the secondary-emission factor has its maximum value. Analysis of high-frequency operation shows that oscillations can be produced at cm λ.

621.385.2/.3].029.63 : 621.317.3 **3801**

Conductance and Slope Measurements on Transit-Time Diodes and Triodes.—Gundlach & Lonsdorfer. (See 3688.)

621.385.3.029.62/.63 : 621.397.62 **3802**

A U.H.F.-V.H.F. Television Tuner using Pencil Tubes.—Harris & Thompson. (See 3765.)

621.385.3.029.63 **3803**

Development of the Premium Ultra-high-Frequency Triode 6J4-WA.—G. W. Barclay. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 293–302.) This valve is a version of the Type-6J4 for military applications. Modifications leading to improvement of inter-electrode insulation, reduction of heater-to-cathode leakage and reduction of grid-to-cathode shorts are indicated, and the manufacture of the close-wound grid is described. The importance of quality control is emphasized.

621.385.4 : 621.396.61.029.63 **3804**

A Novel Ultra-high-Frequency High-Power-Amplifier System.—Koros. (See 3770.)

621.385.5 : 681.142 **3805**

Binary Adder Tube for High-Speed Computers.—F. B. Maynard. (*Electronics*, Sept. 1955, Vol. 28, No. 9, pp. 161–163.) The composite valve described replaces a typical binary adder circuit employing eleven valves. It may also be used as a coincidence detector, etc.

621.385.83 **3806**

Electrode Shapes for a Cylindrical Electron Beam.—P. N. Daykin. (*Brit. J. appl. Phys.*, July 1955, Vol. 6, No. 7, pp. 248–250.) A new approximate analytical solution of Laplace's equation for the e.s. potential outside the space-charge region is derived and numerical tables are developed for applying the appropriate boundary conditions to give the required electrode shapes. A plot of the electrode shapes, applicable to both solid and hollow beams, is presented.

621.385.832 **3807**

A New Method for magnifying Electron Beam Images.—W. R. Beam. (*RCA Rev.*, June 1955, Vol. 16, No. 2, pp. 242–250.) A magnified spot is obtained in a c.r. tube by deflecting the beam across a small aperture and again deflecting the transmitted beam and tracing the image on a fluorescent screen. The procedure is useful in electron-gun design work.

MISCELLANEOUS

061.4 : 621.39 **3808**

Radio Show Review.—(*Wireless World*, Oct. 1955, Vol. 61, No. 10, pp. 476–491.) A trend towards basic circuit standardization in television receivers was noted; more sets were fitted with a.g.c. in the vision channel, the majority making use of the mean bias voltage developed on the grid of the synchronizing-signal separator; true gated a.g.c. systems were rare. On the sound channel a.g.c. was practically universal. For station selection many sets had turret tuners with separate coils for each channel. Incremental-inductance tuning was also common. Convertors were available for most band I sets to enable them to be used on band III. Aerials for television reception were very varied. Printed circuits were common for filters and crossover networks. In v.h.f. f.m. sound receivers precautions were taken to prevent oscillator radiation. Progress in transistor design is shown both for a.f. and h.f. amplification and for power rectification. For d.c. conversion, efficiencies as high as 80% are attained. For another account see *Wireless Engr*, Oct. 1955, Vol. 32, No. 10, pp. 280–285.

061.4 : 621.39 **3809**

British Aircraft Radio.—(*Wireless World*, Oct. 1955, Vol. 61, No. 10, pp. 491–494.) Apparatus shown at Farnborough in 1955 reflected the continuous progress in reducing the size and weight of airborne gear. Navigational aids included new direction-finding and position-finding systems. Other exhibits included communication equipment for use on the 225–400-Mc/s band and sets with valves entirely replaced by transistors.

061.4 : 621.39 **3810**

German Radio Show.—(*Wireless World*, Oct. 1955, Vol. 61, No. 10, pp. 468–470.) In German v.h.f. receivers emphasis is placed on freedom from radiation likely to cause interference. Television receivers for bands I and III have in many cases provision for conversion to band IV. Test and measuring gear was shown by several manufacturers.

621.3.002.2 **3811**

Mechanized Production of Electronic Equipment.—J. Markus. (*Electronics*, Sept. 1955, Vol. 28, No. 9, pp. 137–160.) Present and projected practice in the U.S.A. involves mechanical preparation of components for insertion in etched wiring circuits, followed by automatic assembly, dip soldering and automatic testing of completed circuits. Illustrations of the various processes are given.

413.164 : 621.396/.397 **3812**

Elsevier's Dictionary of Television, Radar and Antennas in Six Languages. [Book Review]—W. E. Clason. Publishers: Elsevier, London and New York etc., 1955, 760 pp. 120s. (*J. Brit. Instn Radio Engrs*, Aug. 1955, Vol. 15, No. 8, p. xi.) The languages included are English, French, Spanish, Italian, Dutch and German.

ABSTRACTS AND REFERENCES INDEX

The Index to the Abstracts and References published throughout 1955 is in course of preparation and will be supplied with the March 1956 issue. Subscribers will receive the Index automatically. As usual, a selected list of the journals scanned for abstracting, with publishers' addresses, will be included.